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CONSTRUCTION INSPECTION GUIDE

VOLUME 2

1976

Municipal Construction Division
Office of Water Program Operations
U.S. ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

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16. ABSTRACT

This guide was issued by the U.S. Environmental Protection Agency for the use of personnel who inspect the day-to-day construction of municipal wastewater treatment facilities. It is intended to assist construction inspectors in examining the detailed construction of the structural, mechanical, and electrical features of a modern facility.

Volume II covers the following topics: structural steel; welding; masonry; carpentry; precast and cast-in-place roof decking; roofing; sheet metal; furring (metal), lathing and plaster; resilient-type floors; dampproofing and waterproofing; corrugated roofing and siding; metal doors, door frames and windows; cabinets, casework and wardrobes; caulking, glass and glazing; terrazzo: ceramic and quarry tile; movable accordion and toilet partitions; hardware; painting; and plumbing and sprinkler systems.

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FOREWORD

The Federal Water Pollution Control Act Amendments of 1972 set in motion a comprehensive program to clean up the Nation's waters. Recognizing that many local governments could not afford to build needed treatment facilities without financial assistance, Congress dramatically increased Federal aid to help local governments meet the requirements of the Act. The 1972 Amendments made available $18 billion in Federal grants to local governments for wastewater treatment works. The program is administered by the U.S. Environmental Protection Agency in cooperation with the water pollution control agencies of the various States.

This Construction Inspection Guide is being issued to aid the engineers and technicans who inspect the actual construction of a wastewater treatment facility. It should serve as a guide in examining the detailed construction of the structural, mechanical, and electrical features of a modern facility. It cannot, however, replace plans, specifications, experience, and most importantly, engineering judgement. Whenever a difference exists between the guide and contract documents, or Federal, State and Local requirements, the contract documents or governmental requirements take precedent.

Comments, recommendations, or suggestions for modification or insertion of additional material are solicited. They should be sent to: Director, Municipal Construction Division, U.S. Environmental Protection Agency, 401 "M" Street S.W., Washington, D.C. 20460.

The Environmental Protection Agency extends acknowledgement to the U.S. Army Corps of Engineers, who originally published this guide, and the Naval Facilities Engineering Command, who provided the negatives, for their joint permission to reprint this guide with minor editorial changes.

John T. Rhett
Deputy Assistant Administrator
for Water Program Operations

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OBTAINING ADDITIONAL COPIES OF THIS GUIDE

This guide is available, free of charge, for personnel who inspect the day-to-day construction of municipal wastewater treatment facilities funded in part, by grants from the U.S. Environmental Protection Agency.

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STRUCTURAL STEEL

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CHAPTER 202
STRUCTURAL STEEL

202-01 GENERAL

This chapter covers structural steel including steel for buildings, hangars, bridges, etc. Welding is covered only generally, since it is more thoroughly covered in Chapter 203.

202-01 SHOP DRAWINGS

a. Structural steel is always erected from approved shop drawings because connections and other pertinent details are not covered on the contract drawings.

b. Approved shop drawings must be on hand prior to the start of steel erection.

c. Particular attention should be given to requirements and arrangement of temporary bracing, guy lines and fastenings.

202-03 STEEL ON THE JOB SITE

Upon arrival of the structural steel and prior to erection, the steel should be checked for the following items:

a. Sizes and Shapes

(1) Check every member against the shop drawings for correct size, shape, and weight.

(2) Check sizes and type of bolts, rivets, washers and welds as well as hole diameters.

(3) Watch for beams made up of welded plates being substituted for a rolled beam.

b. Alignment and Damage

(1) Members must be free of kinks, bends or other distortions.

(2) Check the specifications for allowable tolerances.

(3) No straightening of bent of misaligned members should be allowed in the field except as approved by the engineer.

c. New Steel

(1) Check that the steel furnished is new.

(2) Look for such tell-tale evidence as old rivet and bolt holes which may have been filled with weld material, ground smooth, and painted over.

d. Shop Connections

(1) Has the steel been inspected in the shop.

(a) If no shop inspection, then all shop connections must be inspected in the field with the same care required for field connections.

(b) If the steel has been inspected in the shop, it should be examined upon arrival at the job site to determine if damage has been incurred during transportation or if errors and faulty workmanship may have gone undetected during shop inspection.

(2) Check if column ends, scheduled to be milled, have been milled. Check to determine whether cap and base plates on columns have been welded on in shop, where called for.

(3) For items to check in shop connections, refer to the section in this chapter dealing with field connection.

e. Shop Painting

(1) Inspect shop painting for abraded areas and loose mill scale or rust, making sure that all defects are satisfactorily corrected immediately.

(2) Check the specifications to determine if contact surfaces for joints to be connected with high tensile bolts are or are not to be painted.

(3) Check if painting is required or steel embedded in concrete.

f. Storage and Handling

(1) Steel should be stored neatly off the traveled ways and not scattered all over the site.

(2) Require steel members to be blocked off the ground to avoid corrosion and to aid inspection. For prolonged storage, the steel should be properly protected against the elements.

(3) When unloading or during erection of long flexible steel members or trusses, require the contractor to use a double choker of double sling so as not to overstress the member by picking it up at only one point.

(4) Handling of steel should be such as to prevent distortion or damage during unloading and storage.

(5) Check for adequate connections in partly fabricated units. When not completely riveted in the shop, the units should be bolted to prevent damage in shipment and handling.

202-04. CONTRACTOR'S EQUIPMENT

a. Check cranes to insure that they have been inspected, tested and of adequate capacity for the intended loads at the most critical position and boom radius required by the operation to be performed.

b. Check to insure that the cables are new or are in good condition, not frayed or worn, and that necessary safety stops are installed.

202-05. FOUNDATIONS ALIGNMENT

a. Physical dimensions of foundations should be checked against the contract drawings.

b. Check footings for spacing, elevations and size.

202-06. ANCHOR BOLTS

a. Prior to the erection of structural steel, the anchor bolt settings should be check for accuracy of layout.

b. Check to insure that sufficient length or bolt is protruding above the concrete to allow full engagement by the nut.

c. Chipping of concrete and bending anchor bolts to fit bearing plates is not permitted.

202-07. STEEL ERECTION

a. Bearing-Plates

(1) See that temporary connections necessary to hold all steel in proper position are provided. Before permanent rivets, welds, or bolt connections are made, make sure that the steel members are accuratley fitted, aligned, plumbed, and leveled.

(2) Check that top of concrete is clear of dirt or foreign material and laitance.

(3) Check that bearing plate is set at proper line and level or slope, as required for alignment of frame, and firmly anchored down over metal wedges, shims and/or setting nuts. The space between top of concrete and bottom of bearing plate should be a minimum of 1/24 bearing plate width.

(4) Shims should be steel plates of varying thicknesses and not nuts or odd pieces of metal.

(5) The frame must be plumbed and properly guyed before making final adjustments to setting. Setting shims and wedges should be snugly fitted so they cannot be easily dislodged.

(6) Check that the dry-pack bedding mortar between top of concrete and bottom of bearing-plate is properly rammed and completely placed.

(7) Check that provision is made for proper curing of exposed edge of mortar bedding.

(8) Shims and wedges should remain in place. Parts projecting beyond edge of bearing-plates should be cut off.

b. Alignment

(1) Check that all steel members are accurately fitted, leveled, and guyed and adequate temporary connections made before permanent riveted, welded, or bolted connections are completed.

(2) Do not permit rough handling of material, such as heavy pounding with sledges.

(3) Driftpins may be used only to bring together the several parts; they should not be used in such a manner as to distort or damage the metal.

(4) Do not permit the use of a gas-cutting torch for correcting fabrication errors on any major member in the structural framing. Its use will be permitted on minor members when the member is not under stress and then only with the approval of the Resident Engineer.

c. Guys and Supports

(1) Check guys and supports for size and condition, adequacy of anchorage and suitability of anchorage points.

(2) Guy-lines must be taut.

(3) Check that contact between guy-lines or braces and erection equipment is avoided.

(4). Procedures which might cause back-guys to break during plumbing-up or erection operations should not be permitted.

d. Field Connections

(1) Riveted Connections

Some of the items to check in riveted connections are as follows:

(a) The burning of misaligned or unfair rivet holes should not be permitted.

(b) Drifting to enlarge unfair holes shall not be permitted. Holes that must be enlarged to admit oversized rivets should be reamed.

(c) Poor matching of holes should be cause for rejection of the member.

(d) There should be no space between the members to be connected; members cannot be pulled together by rivets.

(e) Heads of the rivet should be in line, as a rivet which is not centered on the hole is of little or no value.

(f) Pitted or pock-marked heads indicate overheating or burning of the rivet.

(g) Marks or deformations in the steel around the edge of the rivet indicate that the gun was against the steel and not the rivet.

(h) Rivets with malformed heads, such as derbys, jockey-cap, etc. are due to being to driven while too cold.

(i) Reheating and reforming of defective rivet heads should not be permitted.

(j) All rivets should be checked for looseness by tapping with a hammer. One method of doing this is to take a washer, hold it against one head of the rivet and tap the other head. If the rivet is loose, the washer will bound away.

(k) Rivets unsuitable for any of the reasons noted should be marked for removal with the chisel end of the hammer. Follow up to determine that unsuitable rivets have been removed and replaced with satisfactory rivets. In the removal of rivets, see that no damage has been done to adjacent steel.

(l) If one-third or more defective rivets are found in one connection, the complete connection should be redriven since removal of defective rivets may loosen the remaining rivets in the connection. If all rivets are not removed, recheck all rivets after defective rivets are replaced.

(m) Check to see that rivets are painted after driving and that other damages to shop coat of paint are touched up.

(2) Bolting, General

(a) Bolts and rivets should not be allowed in the same connection in the final structure.

(b) Check type, length and size of bolt, size and type of washers, and size of hole.

(c) Check to assure all bolt heads and nuts are resting squarely against the metal, and that boltshave been drawn adequately tight.

(d) Check for the requirements for upset threads or lock washers and for compliance with these requirements.

(e) Check for alignment of holes. Poor matching of holes should be cause for rejection of the members. Burning to correct misalignment should not be permitted.

(3) High-strength Bolted Connection

(a) The high-strength bolt is identified by three radial marks on the head and three long indented marks on the nut. The bolt is used with a washer on the side of the element that is turned, and a nut, all made of high carbon steel. The inspector should make sure that ordinary washers and nuts are not being used and he should have available AISC Pamphlet "Structural Joints Using ASTM A 325 Bolts". Recommendations on inspection should be followed.

(b) Some of the items to check in a high-tensile, bolted connection are as follows:

1. Unless noted otherwise in the specifications, contact surfaces of a high-tensile bolted connection should carry only the normal tight mill scale and should be free of dirt, oil, loose scale, burns, pits, and other defects that would prevent the solid seating of the parts.

2. Check the specifications to determine whether or not the contact surfaces of high-strength bolted connections should be painted.

3. The contractor should provide the means and should calibrate twice a day all wrenches to be used for high-strength bolting.

4. Check required bolt tension by use of a calibrated wrench furnished by the contractor. All high-strength bolts need not be checked. Normally 5 to 10 percent of the bolts should be checked.

(4) Unfinished Bolted Connections

(a) Check to see if specifications require that bolts be dipped in red lead paint before installation.

(b) Check that the same number of threads are exposed in any one connection and that the correct length of bolt is used.

(c) Check for the contractor's use of an approved welding procedure prior to the commencement of welding.

(5) Turned Bolts

Turned or rivet bolts in reamed holes have the same value as rivets. The same checks should be made for turned bolts as for other bolts.

(6) Ribbed Bolts

The ribbed bolt is the equivalent of a rivet and is used without a washer. The same checks should be made for ribbed bolts as for other bolts.

(7) Welded Connections

Some of the items to checkin a welded connection are as follows:

(a) Check on the qualifications of the welders.

(b) Check to see that all of the welds called for on the approved shop drawings have actually been made, and that they are accurately located and of the specified sizes.

Check to see that shop non-destructive tests (Radiographing, Magnifluxing) required by the specifications have been performed and location for the tests are known.

(c) Check finished welds for size, length and standards of workmanship with respect to contour and appearance of the weld surface, surface defects, craters, undercutting, overlapping edges of welds, cracks, etc. Unacceptable welds should be removed, rewelded, and re-examined promptly.

(d) Weld location is important; placing welds in the wrong location may be just as serious as omitting the welds altogether.

(e) Over-welding either in size or length of welds is to be discouraged since such practices may introduce distortions.

(f) Surfaces to be welded should be free from loose scale, slag, rust, grease, paint, and any other foreign material, except that mill scale which withstands rigorous wire brushing may remain.

(g) Joint surfaces to be welded should be free from fins and tears.

e. Inserts and Attachments

(1) Structural steel should not be cut for passage of conduits, pipes, etc, unless shown on the approved shop drawings.

(2) The burning of holes for attachment of supports should not be permitted.

f. Final Painting

(1) Prior to final painting, the steel should be cleaned of all foreign matter and the prime coat touched up, including rivets, bolts, areas welded, etc.

(2) Final coats of paint should be applied prior to surfaces being made inaccessible by masonry, roofing, etc.

(3) Remember that steel to be encased in concrete is not to be painted unless otherwise specifically required.

g. Open Web Steel Joists

(1) Check to see if holes in bearing plate at one end have been slotted, where specified.

(2) As soon as joists are in place, all bridging should be completely installed and the joists permanently fastened into place before the application of any loads.

(3) During the construction period, care should be exercised to avoid excessive concentrated loads.

(4) The ends of all bridging lines terminating at walls or beams should be anchored thereto at plane of top and bottom chords as noted on the drawings or as specified.

(5) See that the principle tension members are the full length of joist without splicing or jointing.

(6) Check the anchorage of the joist to its supports. Check to see that the bearing surface has full bearing.

(7) Do not allow the burning or enlargement of holes in the joist.

(8) Check to see that all rust, scale, weld flux, slag and spatter has been removed and joist is clean before it is painted.

202-08. STEEL TANKS

a. Field inspection of steel tank materials will be made upon delivery, as for structural steel.

b. Foundation pads, anchor bolts, or other supports should be checked before erection of tank starts.

c. In riveted tanks, contact surfaces shall be free of paint or foreign materials.

d. Plates to be riveted shall be carefully and accurately laid up and shall then be firmly drawn together with machine bolts or wedge bolts before riveting starts.

e. Any burned, loose, or defective rivets should be cut out and redriven.

f. Surfaces to be welded should be free from loose scale, slag, heavy rust, grease, paint and any other foreign material excepting tightly adherent mill scale. Surfaces shall also be smooth, uniform and free from fins, tears, and other defects which adversely affect proper welding.

g. Damage to shop coat of paint both inside and outside of assembled tank should be touched-up with specified paint prior to final painting.

h. Ladders and safety cages should be checked for rough or sharp edges, loose rungs, clearances, etc.

i. Field painting should not be permitted until all water, dirt, grease, etc., are removed and the tank surfaces are dry.

CHAPTER 203

WELDING

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CHAPTER 203
WELDING

203-01. GENERAL

a. This chapter covers welding and the general construction inspectors' duties in the inspection of welding. Data and information presented herein apply to structural, piping and plate materials; to all types of ferrous and non-ferrous materials; and to welding processes, gas or electric, associated with EPA Grantee contracts.

b. It is recognized that welding is a specialized subject. The check list items that follow will assist the general inspector in his duties; make him aware of possible poor quality workmanship; and show the need for promptly requesting technical assistance from a qualified welding specialist on questionable items.

c. The resident inspector should have a complete, basic knowledge of welding methods, practices, and procedures. His inspection of welding should assure that quality welding is being obtained.

d. Welding and cutting is the greatest single cause of fire on construction projects. Large fire losses are very common. The continuous occurrence of small fires and the presence of charred combustible material is indisputable evidence of improper and uncontrolled welding procedures and operations. Prior to approval of welding operations, combustible material must be removed or adequately protected. Combustible material such as low density fiber board, bituminous products, vapors and saturated products including vapor barriers, flammable liquids and vapors including paints, varnishes, petroleum, and other materials with high flame spread characteristics if ignited cannot be controlled by first aid fire fighting equipment. Fire prevention and control must be primary consideration on all welding operations.

203-02. GENERAL REQUIREMENTS

Prior to Welding:

a. Check whether welding procedure specifications have been submitted and approved.

b. See that welders have been qualified in accordance with the welding procedure specification.

c. See that testing of welders is done by a qualified testing laboratory.

203-03. DETAIL REQUIREMENTS

Welding Sequence and Procedure Drawings:

a. Check for excessive distortion. Lay welds in a pre-arranged pattern.

b. Check approved shop drawings against contract drawings, noting discrepancies and advising supervisor.

c. Check weld symbols. Interpret correctly.

d. Check placement of welds in designated sequence. Do not permit deviations.

203-04. INSPECTION PROCEDURE

a. General

(1) Be sure that a copy of the American Welding Society procedure specifications for metal arc or oxyacetylene welding is available for your use.

(2) Insure that the approved welding procedure is adhered to.

b. Specific

(1) Process

(a) Identify welding process used, i.e. gas welding or metal arc welding.

(b) Check welding procedure specification for agreement as to correct process to be used.

(c) Carefully inspect the welding of the metals. Watch for burns.

(2) Base Metal

(a) Check mill reports to see that necessary approval action has been taken on material prior to job fabrication.

(3) Filler Metal

(a) Look at container or color coding of electrodes (welding rods) for classification.

(b) Reject all coated electrodes that have been wet or on which the coating has been damaged.

(c) Check diameter of electrodes.

(4) Position - Insure that no welder is welding in any position other than that for which he has been qualified.

(5) Preparation of Base Metal

Observe the joint preparation prior to welding.

(a) See that method of cutting bevel insures parallel surfaces.

(b) Do not allow torch cutting unless special permission has been received.

(c) Inspect surfaces for removal of all dirt, grease, loose scale, slag, or rust.

(d) Examine weld joint for root opening, bevel angle, root face, and groove face.

(e) Verify alignment of material.

(f) Determine allowable tolerances.

(6) Nature of Current (Arc Welding Only)

(a) Check polarity if D.C. current is being used. Either straight polarity or reversed polarity may be used, depending on material welded and electrode used.

1. Check positive and negative leads at welding machine.

2. Use Plates 1 and 2 to identify type of polarity (Pages 203-9 and 203-10.)

(b) Check frequency shown on name-plate if alternating current welders are used.

1. Does it agree with frequency shown on approved welding procedure schedule?

2. Require identical frequencies.

(7) Size of Welding Tips (Gas Welding Only).

Check tip size.

(8) Nature of Flame (Gas Welding Only).

(a) Check flame adjustments.

(b) Check welder's adjustment for application (reducing, oxidizing or neutral).

(9) Method of Welding (Gas Welding Only).

Check method of welding to be used (forehand or backhand).

(10) Welding Technique.

Check actual technique being used.

(a) Examine current and voltage-dial readings at which pointers have been set on welding machine. Require measurement by instruments.

(b) Identify number of passes or beads placed.

(c) Determine diameter size of electrode used for each pass of weld material placed.

(d) Insure that all welds are quality welds, that techniques are such that there is no excessive weld pile ups or spatter, no irregular weld contours, no under cut or no off-center welds.

(11) Cleaning - See that all slag or flux is removed before laying down the next successive weld head.

(12) Defects - Check welding against method noted on welding procedure specifications.

(a) Insure that defects are ground, chipped or chiselled back to sound metal with no irregular edges or areas of stress concentration.

(b) Observe that metal is not rolled over defect.

(c) Inspect for surface cracks in critical areas by magnetic particle testing.

(13) Peening - Check degree of peening permitted and the suggested or approved types of tests.

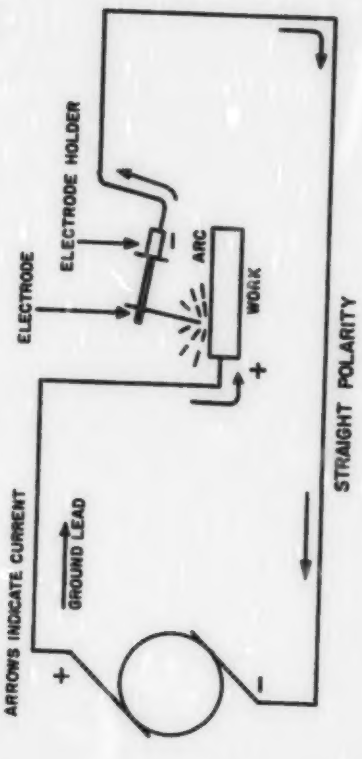
(14) Treatment of Underside of Weld Groove - Check detail and sketches noted on welding procedure specifications.

(15) Preheating

(a) Check requirements.

(b) Check methods of control.

(16) Check to see that all weld flux, slag and spatter is completely removed.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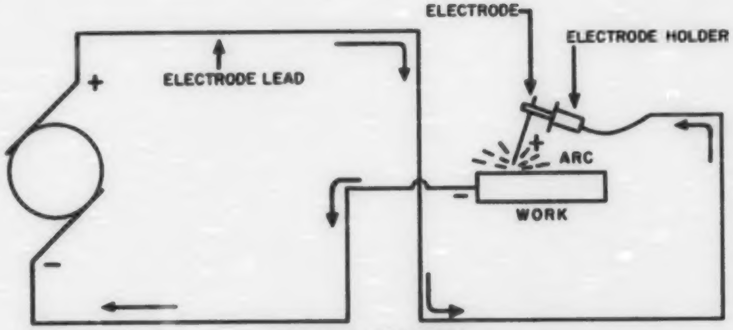
ARROWS INDICATE CURRENT

STRAIGHT POLARITY

PLATE I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REVERSE POLARITY

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CHAPTER 204
MASONRY

204-01. GENERAL

This chapter covers brick, concrete block, cinder block, glass block, tile, stone, and other masonry construction.

204-02. SAMPLES

Have samples of all materials been submitted for approval?

a. Check progress schedule for dates materials are needed.

b. Is contractor submitting samples early enought to avoid delay in construction?

204-03. SAMPLE PANELS

Have sample panels been erected?

a. Are they located so as to be close enough to structure to provide ready access for comparison purposes? Do not permit sample panels to be incorporated in the structure.

b. Have precautions been taken to prevent damage to sample panels?

c. Has location of sample panels been recorded in daily log?

d. Check masonry against sample panels. The materials, workmanship and finished appearance must be the same.

204-04. TESTS

The following listed tests will be required in most contracts; other tests may be specified in some contracts. (For all tests, the inspector's responsibility is the same - to ascertain that the tests have been performed and that results are satisfactory before allowing the use or installation of materials for which tests are required.)

a. Concrete Masonry Units

(1) Drying - Shrinkage Test

(a) Specifications limit shrinkage of units.

(b) The design of control joints and joint reinforcing was based on the specified limit of shrinkage.

(c) This test determines if the shrinkage of units to be used is within the specified limits.

(d) Test Results must be submitted for approval by specified time.

(2) Air - Dry Condition Test

(a) Units passing this test have a proper moisture content and will not shrink excessively from loss of moisture to the air.

(b) The inspector will require that the specified number of representative samples are delivered to the laboratory from each lot. (One day's delivery is considered a "lot" for average job.)

(c) Samples must be sealed in lab-furnished, air-tight containers if testing lab is not in the immediate vicinity of the job site.

b. Tests for Mortar

(1) Contractor is required to have mortar proportions established and tested by an approved laboratory.

(2) A certified copy of the lab-established proportions and test results must be submitted for approval before masonry can be erected.

(3) Check for approved mix proportions and check batching accordingly. (For additional check list on batching of mortar, see "Erection.")

(4) No change in proportioning or source of materials will be allowed without additional tests and approval.

204-05. MATERIALS

a. General

(1) Do materials on site match the approved samples for:

(a) Color or range of colors?

(b) Texture?

(c) Grade? (SW grade brick always used below grade).

(2) Are sizes and defects within permissible tolerances?

(a) Obtain copies of referenced ASTM or other materials specification; tolerances are spelled out.

(b) Use these tolerances as basis for accepting or rejecting units.

(c) Typical defects to look for

are: chips, cracks, checks, crazing, crawling, pop outs, and warped or misshapen units.

(3) Are storage facilities adequate?

(a) Are units stored off ground and completely covered?

(b) Are coverings waterproof; such as tarps, polyethylene sheeting or other waterproof material?

(c) Are coverings secured in place? Are coverings being re-secured at end of each day and whenever rain or snow threatens?

b. Anchors, Ties and Joint Reinforcement

(1) Do materials on site match the approved samples?

(2) Are corrosion resisting metal or metallic rust-resisting coatings required?

(3) On wall and partition intersection ties, check both specifications and plans for specific details as to type, size, shape and material.

(4) Check for omission of anchorage, especially at doors, windows, and other wall openings.

(5) Are anchors with bent ends being grouted into voids?

(6) Cavity-wall Ties

(a) With hollow masonry in either or both the face and backup masonry, rectangular wire ties are required.

(b) Is length such that end anchorage occurs in face-shell-mortar beds?

(c) Are drip bends of ties at center of cavity so no moisture will pass?

(d) Is the 3/16 inch wire either bronze, corrosion-resisting steel or copper-clad steel?

(7) Joint Reinforcement

(a) Is wire zinc coated and does weight of coating comply with specifications?

(b) Are cross-wires spaced as specified for smooth and for deformed longitudinal wire?

(c) Is specified gauge wire being used?

c. Brick

(1) Has certificate of compliance been received?

(2) Do color range and texture match approved samples?

(3) Have broken, cracked, chipped, warped, spalled, oversized and undersized units been rejected?

Obtain copy of ASTM C-62, C-216 or other referenced specification and base acceptance or rejection on tolerances contained therein.

d. Portland Cement, Masonry Cement and Lime

(1) Check shipment containers to be sure materials received are as specified and tested.

(2) If containers are broken or damaged, reject cements or lime.

(3) Pay particular attention to sack or bag type containers for evidence of dampening, hardening or setting up of cement or lime. Cement or lime that has become lumpy or semi-hardened must be rejected.

(4) Any other evidence that material does not meet specifications is cause for investigation and possible rejection.

e. Concrete Brick, Split Block and Concrete Masonry Units

(1) Have Certificates of Compliance been received?

(2) Have units passed the required tests for Drying Shrinkage and Air Dry Condition?

(3) Are all units to be used in any one structure of the same appearance (especially texture)? Have all units been cured by the same process?

(4) Have sizes of units been spot-checked? No overall dimension (width, height or length) shall differ more than the deviation allowed from the specified standard dimensions. (Standard dimensions of units are the manufacturers' designated dimensions.)

(5) Do specifications state locations where bullnose units are required? (Present guide specifications state locations.)

f. Coping Tile

(1) Do tiles overhang parapet on both sides to provide for drip?

(2) Are drip grooves provided?

(3) Are flashings installed, as detailed, under copings?

g. Firebrick

(1) Should be compact of homogeneous structure free from checks, cracks, voids or soft centers.

(2) Do the units carry the required rating or is there a testing agency and statement of results of fire rating test required?

(3) The allowable tolerances for fire brick are as follows:

(a) Dimensions 4 inches and over shall not vary more than ± 2% from that specified.

(b) Dimensions under 4 inches shall not vary more than ± 3% from that specified.

(c) Special shapes shall be free from defects that will prevent ready and accurate laying with a maximum joint of 1/8-inch width.

(d) The standard sizes are shown in the specifications.

h. Flashing Blocks

(1) Diagonal groove no less than one and one-half (1-1/2) inches deep measured horizontally.

(2) Groove continuous around corners and offsets.

(3) Sized to replace and course with two courses of brick.

i. Flue Linings

(1) Is size of flue lining as specified or shown?

(2) Does thimble size match size of boiler breeching or smoke pipe?

(3) Is the hard-burned fire clay or shale free from blisters and warping?

j. Glazed Structural Clay Units

(1) Are the units of the proper finish, texture and color range?

(2) Are bodies of units free from cracks or strength-impairing defects?

(3) Are finished faces covered with ceramic glaze of uniform quality, free from defects which would detract from appearance WHEN VIEWED FROM A DISTANCE OF FIVE (5) FEET?

(4) Obtain a copy of ASTM C-126 or other referenced specification and base acceptance or rejection on tolerances contained therein.

(5) Have units been checked for staining properties?

k. Mortar Materials

(1) Be certain that materials delivered to site are as specified, tested and approved. Check that only one brand of one type of cement and aggregate from only one source is used. Do not allow careless mixing procedures including variations in mortar proportions. Variations from above tend to produce variations in color of mortar when dry. These variations in color are more noticeable in glazed structural facing unit wainscots.

l. Precast Concrete Trim

(1) Has Certificate of Compliance been received and does unit pass absorption test?

(2) Have sills been cast with washes and drip grooves?

(3) Is there a joint in sill at every million?

(4) Inspect for crazing; pour water over precast trim; if present, crazing will be apparent. Evidence of excessive crazing is cause for rejection.

(5) Have units weighing over 80 lbs. been provided with built-in loops of galvanished wire?

m. Pre-faced Concrete Masonry Units

(Option for glazed structural facing-tile-units for base.)

(1) Have certificates and all required

current test results been furnished for units?

(2) Check units for bond between facing and concrete masonry units.

(3) Check unit for chips, cracks, crazes, blisters, crawling, holes and other imperfections detracting from appearance.

(4) Check dimensions, tolerances and requirements.

n. Reinforcing Bars

(1) Are shape, spacing and size of bars as detailed?

(2) Are bars free from scaly rust, oil, grease and grout splashes?

(3) Are splices the same length as specified in "Concrete (for Building Construction)".

o. Sand-Lime Brick

(1) Has Certificate of Compliance been received?

(2) Obtain copy of ASTM C-73 or other

referenced material specification. Base acceptance or rejection of units for size and defects on tolerances in materials specification.

(3) Sand-lime brick will not be used for exterior facing unless its use is specifically noted on drawings.

p. Stonework

(1) Do specifications require shop drawings for stonework?

(2) If shop drawings are not required, it is particularly important that a sample panel be erected and approved by all concerned before starting stonework.

(3) Reject stone with stains, cracks, chips or seams.

(4) Check all work against shop drawings and/or sample panels.

(5) Check anchors, cramps and dowels for specified type of material, size, shape spacing and proper installation.

q. Structural Clay Tile

(1) Has Certificate of Compliance

been received?

(2) Obtain copies of materials specifications. (ASTM C-34, C-56 and E-119 are most commonly referred to.) Base acceptance or rejection of units, for size and defects, on tolerances of materials specifications.

(3) Units shall be free from defects which will detract from the appearance of the finished wall WHEN VIEWED FROM A DISTANCE OF 20 FEET.

(4) Color of tile - Sufficient samples should be submitted and approved to indicate the full range of color normal to the tile. The tile is burned in a kiln and is subject to color ranges similar to brick.

204-06. ERECTION

a. Protection

(1) Is ambient (surrounding) temperature at or above the minimum temperature specified?

(a) For temperatures below the minimum temperature specified, contractor shall submit for approval a written proposal of methods of protecting masonry against cold weather.

(b) Frozen materials shall not be installed or built upon.

(c) Work becoming frozen after installation shall be removed and replaced.

(d) Keep in mind that mortar must be kept continuously above freezing for at least 48 hours after units are laid, never less than 48 hours.

(2) Protective Waterproof Coverings

(a) Waterproof building paper, canvas, polyethylene sheeting and similar materials, not loose planks.

(b) Tied or weighted in place, not just draped.

(c) Are coverings provided at the

end of each work day?

(d) Are coverings provided whenever inclement weather occurs?

(e) Protect the surfaces on or against which additional masonry is to be laid.

(f) Protect tops of complete walls from entrance of water, frost and snow until roof is in place and tight.

(3) Back fill Adjacent to Masonry Walls

(a) Most faces of exterior concrete masonry walls below grade are required to receive parging. Check to see that this parging is troweled to a smooth dense surface and at least one-half inch thick.

(b) Carry backfill up evenly on both sides of wall below grade.

(c) For masonry walls in basements and crawl spaces, it is best to wait until floor slab or framing is in place before placing exterior backfill above the interior floor grade of basement or crawl-space.

b. Erection Procedures

(1) Check masonry dimensions against existing foundations and structural framing.

(a) The two must coincide.

(b) Bring any discrepancies to the attention of your supervisor immediately.

(c) In reinforced concrete structural frame buildings - Are dovetail tie slots installed?

(2) Check vertical coursing against dimensional wall heights. Would a minor change in joint width eliminate a fractional course?

(3) Check horizontal layout by either a dry-run or by tape.

(a) Is joint width proper to avoid fractional length units?

(b) Are openings located so units are of same length against both jambs?

(c) Check for conflicts between openings and partitions or equipment locations.

(d) Check that minor adjustments are made in width of head joints to keep bond plumb.

(4) Check control joints for type and location.

(a) If control joints in concrete masonry units, concrete brick and split-block are spaced more than 25 feet apart, notify your supervisor. (Normal spacing is approximately 15 feet apart, but some designs may have spacing as great as 25 feet.)

(b) Are control joints located at jambs of openings rather than a couple of feet away from openings?

(c) With control joint at jamb, is slip joint provided under lintel? Is slip plane made of 16-ounce sheet copper?

(d) Joint reinforcement does not pass through control joints.

(e) Check drawings for control joints that pass through bond beams (normally occurs at spacing of 60 feet or less).

(5) Is contractor erecting leads at corners and jambs?

(a) Is contractor using a story-pole to establish coursing in leads?

(b) Do not allow complete dependence on string lines between the leads. Use story pole to check coursing between the leads.

(c) Are masons using levels to check plumbness and as straight edge?

(6) Is cutting of block and tile being done by masonry saw? Are blocks being dry cut?

(7) Are all masons finishing joints with tools of same size and shape?

(8) Are masons waiting for initial set of mortar before tooling joints? (At the end of each work day, either the masons must stop laying masonry prior to quitting time to allow mortar to take initial set before tooling, or a mason must be kept on overtime to perform the tooling after the initial set has taken place.) A good rule to follow on the job is that mortar be "thumb print" hard when tooling is done.

(9) If units are moved after mortar takes initial set, remove and replace them, using fresh mortar.

(10) Has excess mortar been removed from faces of units and joints before setting up?

(11) Are flashings installed in base courses, under sills and copings and over lintels and bond beams?

(12) Is joint reinforcing called for? Continuously around building? Under sills? Over lintels?

(13) Are bond beams called for? At floor levels? Under sill? At or above lintel level? At top of wall? At intermediate locations?

(14) Does brick pattern call for header courses? Full or dummy?

(15) Is back parging being installed where specified?

(16) Is parging being done so as to provide the thickness, density and smoothness specified?

(17) Are weep holes required at base of walls, over lintels, over bond beams?

(18) Door and Window Frames

(a) Are the specified numbers of anchors provided for each jamb?

(b) Have hollow door frames been filled solid with mortar?

(c) Is hollow masonry at jambs filled with concrete or mortar for support of lintel?

(d) Check dimensions of approved sash and sills. Will they fit in the masonry opening?

(19) Embedded Items

(a) Check mechanical and electrical drawings for equipment, piping, wiring and conduit locations.

(b) Sleeves and equipment will be built in as masonry is erected, not cut in afterwards.

(c) All cutting and fitting of masonry around equipment pipe lines, etc. shall be done by masons.

(20) Calked Joints

(a) Are control joints being raked out uniformly and to the proper depth?

(b) Check requirements for brick expansion joints.

(c) Are wash-surface joints in precast sills being raked out?

(d) Is calking being accomplished around framed openings as required?

(21) Toothing is allowed only with Contracting Officer approval.

(22) Incomplete walls, not capable of self-support, will be temporarily braced against wind pressure.

(23) Check for bonding of masonry to steel and other rigid construction without provision for expansion and contraction.

c. Batching and Use of Mortar

(1) Is mortar accurately proportioned?

(a) Check against approved laboratory established proportions.

(b) Contractor must provide an accurate volume measuring device, such as a box of one cubic foot volume.

(c) Check proportioning at least once a week and whenever mortar tenders are changed.

(2) Mechanical mixers should be used on all but the smallest jobs.

(3) Quicklime must be slacked (slaked) in accordance with manufacturer's directions. Quicklime putty, except when pulverized, should be sieved through a No. 20 sieve and allowed to cool to specified temperature before using in mortar.

(4) Is mortar being used up within specified time limits?

(a) Contractor has option to have cements tested for initial set and using specified formula for computing time limits.

d. Brick

(1) Has clay or shale brick been tested for rate of absorption?

(a) Test will be performed by approved laboratory.

(b) Brick will be wetted as indicated by test results.

(c) At time of laying, brick will be damp but with no visible water film on exterior surfaces.

(2) Is brick being shoved into place?

(a) Joints should be filled solidly when and as the brick is laid.

(b) Either the "end buttering" or "pick and dip" method is acceptable.

(c) "Slushing" to fill head joints, after brick is laid, is not acceptable.

(d) Check to assure that mortar bond is not broken between newly laid units and their mortar joints.

(3) Is space between brick facing and backup masonry, in solid walls, completely filled with mortar?

(4) Are structural header courses or metal ties installed between face and backup masonry?

(a) Are side joints filled with mortar for entire length of header brick?

(b) Are metal ties of specified material, shape, size and at proper spacing?

(5) Are all exposed joints of uniform width?

e. Concrete Masonry Units

(1) Are starting courses and other specified courses full-bedded under both face-shells and webs?

(2) Are all other courses face-shell bedded only?

(3) Are all units laid up with a full head joint?

(4) Are units checked just prior to installation for chips, cracks, and defective units?

(5) Are joints of uniform width and finished appearance?

(6) Are all cuts being made by dry masonry saw?

(7) Are sizes of units such that difference between vertical faces does not exceed 1/8 inch? (This applies to exposed-to-view and painted masonry in habitable rooms and spaces.)

(8) Is felt paper provided on three sides of mortar key in control joints?

(9) Are control joint blocks available in both full and half sizes? (If only half sizes are available, be sure bond pattern provides for a half unit at the control joint in every course, alternating from side to side.)

(10) Are bond beams constructed entirely of special "U"-shaped bond beam block? (If 10 inch concrete masonry walls are specified, check to see if 10 inch bond beam block is available in your area. If not, notify your supervisor.)

(11) Is reinforcing continuous, including bent corner bars, for full length of bond beam?

(12) Is vertical cell reinforcing in place and concrete fill poured?

(13) Are all lintels of depth specified and with minimum of 8-inch bearing?

(14) Are intersecting partition anchors being installed as exterior walls are erected?

(15) Are ties provided in masonry furring for securing facing units?

(16) Has interior face of exterior walls been dampproofed? Check prior to installing furring for plaster or gypsum board.

(17) Are cuts for electric boxes and panels and other built-in items being made by masonry saws and sized so plate or frame will completely cover them?

(18) Is there a specification that electrical conduit be concealed in 4-inch, exposed, block partitions?

(a) It is all but impossible to construct proper appearing masonry under these conditions.

(b) Bring immediately to the attention of your supervisor.

f. Structural Clay Tile

(1) Has tile been tested for rate of absorption?

(a) Test will be performed by approved laboratory.

(b) Tile will be wetted as indicated by test results.

(c) At time of laying, tile will be damp but with no visible water film on surfaces.

(2) Glazed Tile Wainscots - Use the number of full courses that will come nearest to specified height. If more than 2" below specified height, add another full course.

(3) Joints in glazed tile shall be not less than 3/16 inch nor more than 1/4 inch in width.

(4) Faces of tile will be cleaned with damp rag as work progresses.

g. Cavity Wall Construction

(1) Is water-tightness provided by depressing base courses below finish floor elevations or by means of flashing?

(2) Are flashing and weep-holes provided at base of wall and over lintels, bond and spandrel beams?

(a) Are weep-holes at specified spacing?

(b) Are flashings continuous with water-tight joints?

(3) Are cavities being kept clean?

(a) Is wood strip set across ties to catch mortar droppings?

(b) Is excess mortar, squeezed out of joints, cut off flush on cavity faces?

(4) Are rectangular wire ties, minimum width 4 inches, being used?

(a) Is length of ties proper to provide anchorage in face-shell mortar beds?

(b) Are drips located at center of cavity?

(c) Is spacing of ties as specified?

(d) Have additional rows of ties been installed at jambs of openings, at either side of control joints, and at corners?

(e) Are solid masonry returns at jambs of openings detailed rather than extra ties?

h. Chimneys and Fireplaces

(1) Is flue-lining being carried up integral with masonry?

(2) Is space between masonry and flue lining filled solid with mortar? If there is

more than one flue in the chimney, have masonry wythes (partitions) been installed between flues?

(3) Is thimble sized and located to meet approved smoke pipe?

(4) Is fireplace throat and smoke chamber free of obstructions?

(5) Are damper, lintel angle and ash cleanout installed?

(6) Are required number of metal ties installed for bonding face and fire brick?

i. Anchors, Ties and Joint Reinforcement

(1) Anchors and ties will be installed as the work progresses.

(2) Ties between structural steel columns and masonry walls - Are shims required between column and masonry at the locations?

(3) Ties with ends turned into voids of units - Are ends groutedsolidly in place?

(4) Is joint reinforcing installed with mortar above and below it?

(5) Are sections of joint reinforcing lapped the specified amount with at least two

cross wires of each section within lap?

(6) Check the forming of joint reinforcing around corners.

j. Cleaning of Masonry

A little care during the laying of masonry, including removing mortar droppings and careful tooling of joints, will keep the cleaning operations to a minimum.

(1) Brick and Clay Tile (Not Glazed Tile)

(a) Minimize the cleaning problem. High absorption brick should be wetted before laying.

(b) Make cleaning operation one of last phases of job. Do not start before mortar is thoroughly set and cured.

(c) Remove large particles of mortar with putty knife before washing.

(d) A suitable cleaning agent is one part muriatic acid to nine parts water. If acid is used goggles, gloves and other personnel protective equipment must be provided and used. Scaffold and boat swain's chair ropes must be carefully protected.

(e) Soak area to be cleaned with plenty of water before applying acid.

(f) The brickwork below the area being cleaned should be kept thoroughly soaked with water.

(g) Clean only 10 to 20 square feet at a time for each man.

(h) Scrub the brick, not the mortar joints.

(i) Wash the wall thoroughly with plenty of water immediately after scrubbing with acid.

(j) Repoint as necessary for water tightness and appearance.

(k) Check to see that mortar joints are not damaged or stained by the cleaning agent.

(2) Concrete Masonry Units

(a) Remove excess mortar from joints and faces of units.

(b) Brush all dust and foreign matter from faces of walls.

(c) Never use the acid wash on concrete masonry.

(d) If tooling has not produced

uniform joints, it may be necessary to rub them with carborundum stones.

(e) Repoint joints as necessary for watertightness and appearance.

(3) Glazed Structural Tile

(a) Masons should remove mortar smears from faces of tile with clean damp rags, immediately after laying.

(b) Upon completion of walls, wash all surfaces of tile with soap powder and clean water, using stiff fiber brushes.

(c) Remove hard lumps of mortar with wooden paddles.

(d) Metal cleaning tools, metal brushes and acid solutions should not be used.

(e) Repoint joints as necessary for watertightness and appearance.

204-07. POINTING AND CLEANING

a. Pointing

Has the construction been checked for defects and have defects been repaired? Remember the pointing of joints requires re-tooling.

b. Cleaning

Has all clay brick and clay tile masonry been carefully and thoroughly cleaned with acid?

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CARPENTRY
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CHAPTER 205
CARPENTRY

205-01. GENERAL

This chapter provides a list of items to check during inspection of work performed under the Carpentry section of typical contracts. The items in this chapter can be used by the inspector as a basis around which to build his own inspection check list. The list will vary with the materials specified and with the complexity of the particular contract.

205-02. SHOP DRAWINGS AND SAMPLES

a. Check each contract for items requiring submission and approval of shop drawings. Items requiring shop drawings will vary with the contract.

b. Items commonly requiring shop drawings include:

(1) Exterior doors and frames.

(2) Window frames and non-stock windows.

(3) Completely assembled windows.

(4) Interior wood finish, when so specified.

(5) Finish stair work.

(6) All cabinet work.

(7) Roof trusses.

(8) Prefabricated items.

c. Remind contractor that shop drawings must be submitted and approved prior to fabrication or delivery of materials.

(1) Check that all shop drawings have been submitted and have received approval prior to installation or use of the item.

(2) Check all work for conformance with the approved shop drawings.

d. Remind contractor that all specified samples are required to be submitted and approved prior to delivery of materials to the site.

(1) All approved samples received by the inspection forces should be tagged as to type of use and location and stored in a readily accessible area of the field office.

(2) Check materials delivered to site against the approved samples; they shall be identical.

205-03 LUMBER

a. Species and Grade

Check the species and grade against that specified for each use.

b. Grade Stamp

Check yard and structural lumber for grade stamp.

c. Defects

Check defects against the appropriate grading rules.

(1) Obtain copies of the grading rules and check lumber for:

(a) Tolerance of dimensions.

(b) Imperfections in excess of those allowable, as regards:

1. Checks, splits, shake, pockets.

2. Decay.

3. Grain structure.

4. Knots.

5. Percentage of heartwood or sapwood.

6. Wane (presence of bark or lack of wood).

7. Warp, crook, bow, cup.

Full definitions of the above properties or defects and other grading considerations are included in most of the grading rules handbooks.

d. Moisture Content

Check the specifications for the allowable moisture content of lumber.

(1) Moisture content can be readily checked in the field with a moisture meter.

(2) Moisture content can be checked in a laboratory by the over drying process.

(3) Lumber

treated with a water-borne preservative will have a moisture content not to exceed 19 percent.

(4) Exterior and interior finish lumber and flooring:

(a) When 1-inch thick or less, is moisture content 12% or less?

(b) When over 1-inch thick, is moisture content 15% or less?

(c) When pre-assembled mill work is composed of more than one piece and assembled in the mill; is moisture content 12% or less?

e. Storage

(1) Boards and Dimension Lumber

(a) Lumber stored off of ground in properly drained area?

(b) Covering adequate to prevent increase in moisture content?

(c) Lumber stacked to prevent warp?

(2) Finish Lumber, Flooring and Mill Work

(a) May be stored at the site only in weathertight sheds and at the risk of the contractor.

(b) Should not be brought into building until plaster is dry and windows and doors are installed or temporary inclosures provided. If during heating season, either permanent or temporary heating should be provided.

f. Preservative Treatment

(1) Obtain affidavit on preservative treatment wood, stating retention, paintability, drying time, surface deposit and moisture content.

(2) When bottoms of floor framing and subflooring are 24" or less from earth, they shall be treated.

(3) Exterior wood steps, platforms and railings shall be treated.

(4) Wood nailers set in or on exterior concrete or masonry shall be treated, including:

(a) Nailers at eave or rake of roof.

(b) Wood sleepers.

(c) Furring strips attached to interior face of exterior walls.

(5) Creosote cannot be used as preservative for sleepers, joists, flooring, or when:

(a) The creosoted material will be in contact with absorptive exposed finish material such as plaster or gypsum board.

(b) The treated material is to received a painted finish.

(6) Check specifications for requirement of preservative treatment on exterior millwork.

(7) Check for touch-up of ends or edges which are cut or planed after original treatment.

205-04. CONCRETE FORMS

a. Line and Grade

Start with the footings and check for conformance.

b. Joints

Check the face of forms for tightness to prevent loss of grout.

c. Re-Used Formwork

Check for patching or plugging of all holes. Finish on the concrete will be no better than the face of the forms against which the concrete is placed.

d. Materials and Procedures

Check to make sure that the form material proposed will produce the specified end product. Also make sure that that forming method and procedures will produce the specified finish.

e. Stud Spacing

The spacing should be uniform and such that no discernible deflection of the sheating will take place.

f. Walers

(1) Is spacing of walers at proper interval to hold the studs in good alignment?

(2) Are splices in walers staggered so as not to occur all in the same panel?

(3) Is a plate provided across tops of studs or is there a waler located close enough to maintain good alignment at top of form?

g. Tie-Rods

Is spacing sufficient to support load and maintain alignment?

h. Braces

Has sufficient number been provided to maintain vertical alignment?

(1) See that all braces are at an angle of 45° or less (interior) with the horizontal at the base of the braces.

(2) If a series of braces originates from the same anchor point, are the braces tied together vertically half way between anchor and form?

i. Shores

Check that they are tied off in four directions at enough points to prevent bending or movement. After leveling shores, have wedges been nailed in place?

j. Nailing

Check that enough nails have been used to hold each board or panel of the form sheathing tight against studs or joists.

205-05. FRAMING

a. General

(1) Check framing for accuracy of line, level, fabrication and fitting. Exterior wall studs should be checked for plumbness and alignment before exterior masonry work is begun.

(2) Check connection and method of rigidly securing all members.

(3) Carefully check for first class workmanship as compared with applicable requirements of the American Institute of Timber Construction Publication.

(4) Do not permit the arbitrary cutting or notching of framing members.

(5) Require the framing of all openings.

(6) Check to see that a 2 inch space is maintained between chimney and timber and 4 inches between fireplace backwall and timber.

(7) Check for the leveling of timber on masonry and concrete with slate or steel shims and do not allow the use of shims on wood or metal bearings.

b. Framing Details - Check with specifications and contract and/or shop drawings.

c. Anchorage to Concrete and Masonry

(1) Is anchorage provided near the end of each section of sill or ledger as well as at the specified spacing?

(2) Are ends of every fourth joist anchored as specified?

(3) Are joists which parallel masonry walls anchored every eight feet? Are anchors extended over and fastened to three joists?

(4) Are anchors provided for window frames and door bucks?

(5) Are anchors provided for wood sleepers?

(6) Are anchors provided for plates on concrete floors?

(7) Are anchors provided for end studs of partitions abutting masonry?

d. Framing Floors, Ceilings and Roofs

(1) Are joists spaced as detailed or specified?

(2) Check that a minimum of 4-inch bearing is provided.

(3) Check "built-in" joists for fire cut.

(4) Are bridging and blocking installed where shown or specified?

(5) Is nailing of lower ends of cross bridging left until after sheathing or subflooring is in place?

(6) Check sizes of openings through joists. Is doubling up of headers and trimmers required.

(7) Check for joist hangers where framed into headers and girders.

(8) Are splices over bearings lapped and spiked or bolted?

(9) Are 2x4's framed between joists or sleepers for support of cut ends of diagonal subflooring?

(10) Check for ventilation between sleepers by notching the end blocking described in (9) above.

(11) Where joists bear on bottom flange of steel beams, are metal ties carried across beam on every fourth joist?

(12) Are joists doubled up under partitions which run parallel with the joists?

(13) Are bolt heads which are countersunk below surface of nailers fastened on top of steel beams or bar joists?

(14) Are structural members framed for the passage of pipes or ducts?

(15) Structural members shall not be cut, notched, or bored more than one-fourth their depth without adequate and approved reinforcing.

(16) Check installation of roof nailers

(vented and non-vented), cants, and roof framing for fascias, eaves, cornices, etc. Check size, shape (groove area in vented nailers), and nailing.

e. Wall and Partition Framing

(1) Check stud spacing. Is it as detailed or specified?

(2) Are top plates doubled up for bearing walls and bearing partitions?

(3) Check for horizontal blocking.

(4) Check specifications. Is solid bearing specified for all edges and ends of gypsum board, plywood, fiber board and similar sheet materials? If so, check for continuous blocking between studs, joists and/or furring.

(5) See that nailing of studs to plates is sufficient to prevent twisting.

(6) Is diagonal wind bracing called for?

(7) Is solid blocking provided for the hanging of fixtures, handrails, cabinets, base board or wall hung heaters and similar items?

(8) Check doubling of studs at openings.

(9) Headers.

(a) Are headers for narrow openings composed of two studs set on edge?

(b) Are headers for wide openings constructed as detailed on the drawings?

(c) Check bearing of header members on studs at both ends.

(10) Soundproof partitions

(a) Are split plates called for?

(b) Are studs staggered as specified?

(c) Is insulation woven in between studs as specified? Fastened only to every other stud?

(11) Vertical alignment of studs

(a) Studs shall be selected to provide true plane surfaces.

(b) Check after installation, for crook, bow, twist, oversized knots and other imperfections over and above previous inspections. Unsuitable material shall be repaired or removed and replaced as required by the specifications.

(c) For wood, dry-wall or any sheet panel surfacing, it is especially important to check every stud for plumbness and minimum crook or bow.

(d) Method of repair shall be restricted to an occasional stud and under no circumstances shall two or more adjacent studs be kerfed and scabbed.

f. Sheathing and Planking

(1) Check sheathing or planks against specification requirements for type of material, thickness, width, and length.

(2) Are sizes and lengths of nails or fasteners as specified?

(3) Check whether horizontal or diagonal application is required.

(4) Do end joints occur only over framing members, and are boards accurately sawed?

(5) Is specified sheathing paper being installed as soon as practical after sheathing installation?

(6) Check fastening to every bearing for specified number of nails or for nails at specified spacing.

(7) Check plywood sheathing for type, grade, and thickness required.

(8) Staples are not permitted for securing plywood sheathing and subflooring.

(9) Wood Sheathing

(a) Are all courses driven up tight?

(b) Are joints staggered with at least two boards between joints?

(10) Is 1/8-inch expansion allowance made at edges and ends of fiberboard sheathing?

g. Furring Strips

(1) Provide "a true even plane for finish material."

(2) The true plane cannot be achieved by nailing furring directly to framing members and then applying finish.

(3) Check with straight edge and/or stringline.

(4) Shim between furring and framing as necessary to produce a "true even plane". This is necessary on all walls as well as ceilings.

(5) Furring strips are "wood nailers" and are required to have pressure preservative treatment when fastened to the inside face of an exterior masonry or concrete wall.

205-06. FLOORING

a. Subflooring

(1) Check joists or sleepers for level and plane surface before installing any type subflooring.

(2) Wood Subflooring

(a) Matched and dressed boards shall be installed at right angles to joists in attic storerooms.

(b) Under wood finish flooring, square edged boards, laid diagonally, will be used and set approximately 1/8-inch apart.

(c) Are locations of end joints staggered and over bearings?

(d) Are boards nailed to every bearing with correct size and number of nails?

(3) Plywood Subflooring

(a) Inspect for specified type, grade and thickness.

(b) Under resilient flooring, is continuous blocking installed between joists for specified edge nailing of plywood?

(c) Check nailing of sheets.

(4) After installing subflooring and before finish flooring is installed, match surface with straight-edge and level for true plane surface.

b. Finish Wood Flooring

(1) Examine condition of subfloor, before finish floor is laid.

(a) Is any material damaged to the extent that replacement is necessary?

(b) Look for loose boards or sheets.

(c) Observe subfloor for cupping. If additional fastening does not correct it, then remove and replace subfloor.

(d) Has expansion been provided for around the perimeter of finish floors?

(e) Check that subflooring is clean.

(f) Check that felt paper is laid down just ahead of flooring.

(2) Before bringing finish flooring into building:

(a) Have doors and windows been installed or temporary enclosures provided?

(b) Is plastering or any other moisture producing construction complete and dry?

(c) Can the temperature in the areas to be floored be maintained above 50° F. for the required number of days prior to installation of flooring and continued until the building is transferred?

(3) After delivery, check:

(a) Species, size and grade. Use grading rules established by contract specifications.

(b) That flooring is stored in the space to be floored for at least 72 hours prior to laying. Storage temperature should exceed 50° F.

(4) Floor Laying

(a) Strip Flooring.

1. Are the proper size approved nails being used?

2. Are eightpenny spiral or screw type flooring nails being used?

a. Are nails spaced no greater than 12 inches on centers?

b. Are both ends of each strip nailed?

3. Are joints being driven up tight?

4. Are end joints alternated so that there are at least two courses between joints?

(b) Block Flooring

1. Check flooring manufacturer's printed specifications for preparation of subflooring to receive adhesively applied wood flooring. Is a vapor barrier specified over or under concrete slabs on grade?

2. Nailing of block flooring to wood subfloor shall be the same as specified for strip flooring.

3. Are joints being driven up tight?

4. Check for premolded cork strips in expansion spaces as may be specified.

(5) Is there allowance for expansion around perimeter of flooring?

(6) Hold off sanding and finishing until finishing operations are complete on other surfaces, particularly walls and ceilings.

(7) After finishing of floors, provide protection, such as building paper, wherever necessary to prevent damage to finish.

c. Check carefully on the operations of subcontractors and installers where equipment such as refrigerators, washing machines, cooking stoves, kitchen cabinets and similar equipment is being installed after installation of finish flooring. These items shall be lifted into place, not dragged:

205-07. DRYWALL CONSTRUCTION

a. To produce a satisfactory finished surface, the following conditions should be met:

(1) Gypsum board should be stored only in dry, well ventilated and completely closed-in sheds or buildings.

(2) Gypsum board should not be brought into the guilding under construction until the building is completely closed in.

(3) Cold weather installation: For installation of the board, temperature should be maintained above freezing at the time of joint cement application.

b. Inspect all surfaces to receive drywall for conformance to grade and line as outlined in "Framing" above.

c. Check contract. Are all edges and ends of each sheet to have continous bearing?

d. Determine method of installation which will result in the least number of joints; horizontal or vertical.

e. Is gypsum board being held tight against supports while nailing?

f. Is nailing started in center of sheets and carried progressively towards edges and ends?

g. Check nailing. If paper surfacing is broken around a nailhead, require an additional nail to be driven approximately two inches away. Check the spacing of the nails.

h. Check clearance allowed in cutting and installing sheets so that they are not being driven in place.

i. Check location of cutouts for electrical boxes and other equipment projecting through the finished surface so that sheets are not damaged when erected.

j. Are damaged sheets being set aside? Undamaged portions of sheets may be used in locations requiring less than full sheets.

k. Check for close adherance to details and specification requirements for walls around bath tubs and showers.

l. Sheets damaged after erection shall be removed and replaced. Patching should be restricted to only minor imperfections.

m. Inspect concealing joints and nailing depressions.

(1) Require application of thin coat of cement over the tape immediately following the installation of the tape.

(2) Check for three coats of cement on joints and nailing depressions with a minimum of 24 hours drying time between coats.

(3) After final coat of cement has dried, see that all coated areas are sanded as necessary to provide a smooth true surface. Check to see that the final coating has been feathered out 12 to 16 inches on both sides of the joint.

(4) If an occasional isolated bubble appears in taped joints, it can be slit open, a coat of cement applied under bubble, and the tape resealed in position. If tape should have to be removed, the joint will be entirely refinished.

(5) Check the requirements for Internal and External corner treatments.

205-08. MILLWORK

a. General - Check millwork against specifications and details of shop drawings and/or contract drawings.

(1) Is preservative treatment required for any components, especially those to be in contact with concrete or masonry?

(2) Check for water-repellent preservative requirements.

(3) Inspect condition of materials, warps, splits, and damages.

(4) Insure that back-priming has been accomplished where specified.

(5) Have anchors been provided as specified or detailed?

(6) Are fastenings the type, size and spacing specified, or shown?

b. Doors

(1) View rough openings in wood framing for the following:

(a) A maximum width of 3/4 inch larger than the overall width of frame is permitted. Less than the 3/4 inch allowance is preferable.

(b) Height of framed openings shall be a maximum of 3/8 inch greater than height of casing.

(2) Look for specified blocking between frames and rough bucks or openings.

(3) Evaluate flush doors for internal solid blocking for hinges and hardware.

(4) Measure for specified clearance between doors and frames after door is hung.

(5) Observe for fit, alignment or warping of doors.

(6) Check exterior doors and frames for weather-stripping, calking and flashing.

(7) Fitting and Hanging

(a) Inspect doors furnished against approved samples for each type and location.

(b) Examine for N.W.M.A. stamp on door or certificate of compliance, as specified.

(8) Check for weather-stripping and specified astragals on double doors.

(9) Are casings mitered at corners and set back 3/8 inch from face of jamb?

(10) Check to see that all cut edges and ends are resealed after fitting or trimming.

c. Wood Windows

(1) Check windows and frames against approved shop drawings.

(2) Is there a weather break in top of sill?

(3) Is underside of sill kerfed or otherwise protected against cupping?

(4) Is sash fitted closely to frame?

(5) Can sash be moved freely?

(6) Do weights or springs provide good balance?

(7) Check for specified weather stripping, calking and flashing.

(8) Double hung sash over 3 feet 4 inches in width requires bottom rail of upper sash to be rabbeted full length and reinforced with a zinc-coated steel angle.

(9) Check for window cleaning provisions where sills of double hung

windows are more than 7 feet above the ground or other horizontal surface. Window-cleaners' bolts and/or removable or reversible sash should be installed.

(10) Are casings mitered at corners?

205-09. EXTERIOR FINISH

a. Determine material type, grade, and length of boards to be used, and condition of material.

b. Inspect for excessive bowing, warping, or damages of such items as trim, fascia, molding, column, and siding.

c. Observe alignment of items.

d. Check for workmanship such as sawing, fitting, appearance and location of splicing, coping, shouldering, mitering, excess splices, etc.

e. Are joints of built-up items glued?

f. Are end joints of wood siding made with white lead paste?

g. Are exposed surfaces sanded smooth?

h. Has preservative treatment been provided as specified?

i. Are nails set and putty stopped?

j. Are door- and window-trim and moldings in single lengths?

k. Are joints of built-up members staggered?

l. Are joints in exterior millwork constructed so as to be weather tight?

m. For wood shingles, check to assure that:

(1) Starter courses doubled.

(2) Weather exposure, as specified.

(3) Nailing is 1" above butt line of the next course.

(4) Joints are kept out of vertical alignment at least 1 1/2".

n. Examine specifications for application of wood shingles.

o. Check for priming of all sides and edges of exterior woodwork. This applies especially to the backside of fascia, soffits, and trim.

205-10 INTERIOR FINISH

a. Insure the correct quality of each piece of material used.

b. Are grounds provided to which to nail trim?

c. Are exposed surfaces sanded smooth?

d. Are backs of trim, to be installed against wood or plaster, hollow?

e. Are joints tight, sawed and fitted accurately, and made to conceal shrinkage?

f. Are finish nails used to secure trim set for putty stopping?

g. Are door- and window-trim, pilasters, newels and posts of single lengths?

h. Are bases set in place after floor is laid?

i. For wood finish flooring, is shoe mold nailed to base only?

205-11. INSULATION

a. Vapor Barrier

(1) Check for specification requirement of a vapor barrier.

(2) Is vapor barrier being located against the surface shown on the drawings?

(3) Are joints lapped and sealed as specified?

b. Inspect insulation for type, weight, and/or thickness.

c. Are edges of batts or blanket-type insulation secured to supporting members to produce a continuous seal against air infiltration?

d. If single reflective insulation is installed, make sure reflective side is installed on the side of the insulation specifield.

e. Check specifications carefully for installation requirements for each type of insulation.

(1) Are flanges lapped as required?

(2) Are all lapped joints made over supports?

(3) Is insulation secured to each support with large head nails or staples spaced not over six inches on center?

f. Insure the protection of insulation against migration.

g. Observe for later damage of misplacement of insulation by electricians, plumbers, etc.

205-12 HARDWARE

a. Hardware shall be installed and fastened in place in accordance with the manufacturer's directions.

b. Are hinge pins plumb through all hinges on any given door?

c. Does all hinged, pivoted, sliding or otherwise movable hardware work free and easy?

d. Materials to which hardware is attached, are not to be damaged during the installation.

e. Door closing devices should not interfere with screen or storm door operation or block openings.

f. Determine number of keys required and have all keys tagged as to location.

g. Check that master keys will operate all the locks and that tagged keys fit the locks for which they are intended.

h. Final acceptance of hardware will require a demonstration that the hardware does perform its function satisfactorily.

i. Have tamper-proof hinges been provided at all exterior doors?

CHAPTER 206
PRECAST AND CAST-IN-PLACE ROOF DECKING
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CHAPTER 206
PRECAST AND CAST-IN-PLACE ROOF DECKING

206-01. GENERAL

The next few chapters contain brief checklists for some of the materials that are used in building construction. The inspector may use the items included here as a start in preparing his own checklist.

206-02. PRECAST CONCRETE AND GYPSUM: PRECAST INSULATING CONCRETE, CAST-IN-PLACE PERLITE, VERMICULITE, FOAM CONCRETE, AND CAST-IN-PLACE GYPSUM CONCRETE

a. Shop Drawings

Have shop drawings of roof decking installation been submitted and approved?

b. Certificates and Samples

Have certificates of complaince and samples been received and approved?

c. Verifying Dimensions and Locating Items that go in or Through Slabs

Has the contractor verified all dimensions and become aware of all items that affect the placing of the floor and roof deckings, and has all discrepancy been reported?

d. Cast-in-Place Gypsum Concrete

Evaluate formboard system for strength, conformance to line and grade and tightness.

(1) Check formwork for compliance with approved shop drawing, line and grade and tightness requirements. Are the approved sub-purlins and insulation being installed properly?

(2) Set screeds to provide a true plane surface, free from depressions or other irregularities.

(3) Is screed-bar rigid enough to produce a true plane between supporting screeds?

(4) Provide protection for adjacent surfaces against leakage or spillage of gypsum concrete. If gypsum concrete should spill or leak onto adjacent surfaces, wash it off immediately with clean water.

(5) Insure that sub-purlins are bearing on and welded to structural members.

(6) See that heavier-gage wires of reinforcing are at right angles to the sub-purlins.

(a) Are ends of reinforcing lapped the required amount?

(b) Are sides of reinforcing butted or spaced approximately 4 inches apart?

(c) Is reinforcement anchored to structure?

(7) Check the mixing and placing operations to assure compliance with manufacturer's printed instructions.

(8) Protect slabs against rain, snow, frost, and freezing during and after pouring.

(9) Check application of built-up roofing. Slabs must be thoroughly cured and surface dry.

(10) Check finish on underside of slab to see that the finish appearance is acceptable.

(11) Check for proper ventilation of area beneath slab during curing period.

(12) Check residual moisture content of gypsum slab with moisture meter where suspended ceilings are installed to see that moisture content of slab is not more than 19 percent before installing ceiling.

e. Cast-in-Place Perlite, Vermiculite and Foam Concrete

(1) Check contractor's proposed concrete with approved design mix. Check the materials to be incoporated into mix.

(2) Check such material items as forms, supports for forms, reinforcements and ties.

(3) Compare contractor's method of installation of formboard system with the approved submittal.

(4) Check installation of wire mesh, lap of fabric, tying of fabric, fitting and anchoring of fabric, and securing of reinforcement mesh in proper position.

(5) Carefully check method of transporting and placing mix. Check temperature requirement.

(6) Make field-control specimens for strength and weight tests of concrete.

(7) Check for the proper forming of expansion joints at vertical surface junctions and at intermediate intervals not to exceed 50 feet.

(8) Check the curing of the concrete. Do not allow the surface to dry out during the curing period.

(9) Concrete shall be thoroughly cleaned and dry before the application of roofing.

f. Precast Gypsum, Precast Concrete, and Precast Insulating Concrete

(1) See that contractor has received an approved design mix and that the material cast was in accordance with the approved mix. Require proof that material in cast slabs was tested and slabs are of adequate strength.

(2) Evaluate slabs for correct dimensions and uniform size.

(3) Check for cracks and deformities. Identify rejected units for removal from site.

(4) Require the slabs to be properly cured, marked and stored.

(5) Precast units will be placed by experienced workmen. Observe the manner of handling and placing of unit. Watch for bending.

(6) See that each unit placed is tight against the adjacent one.

(7) Note the requirement for bearing. Is cement mortar required for bearing and does each plank bear on at least two supports with no less than 2-inch bearing?

(8) Check reinforcing, if required, for correct size, spacing, and clearance.

(9) Check clip attachment at spacing as shown on shop drawings or recommended by manufacturer. (Normally each plank will be clipped at each point of bearing.)

(10) Check anchoring of slabs.

(11) Place cut ends over supports at the wall or openings, if installation requires cuttings of slabs.

(12) Check for cants at all intersections of roof with vertical surfaces and transition fills between changes in elevation.

(13) Check for copies of dusting test certification for precast insulating concrete plank and tile.

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CHAPTER 207
ROOFING

207-01. BUILT-UP ROOFING

a. Materials

(1) See that approved materials are being used.

(a) Check for use of proper type asphalt for roof slope involved.

(b) Require the metal disks to be at least 1 inch in diameter.

(c) The sheathing paper should be rosin-sized, weighing at least 5 pounds per 100 square feet or unsaturated felt weighing at least 7 1/2 pounds per 100 square feet.

(d) Check nails and fasteners for coating required, for proper length and for holding power.

(e) The insulation must be approved thickness, type, and treated or faced as required.

(f) Check vapor barriers for proper type, thickness and quality.

(g) Roll roofing should be of the specified weight and mineral surfaced roll roofing provided with the proper selvage.

(h) Surface material of specified gradation and quality is required.

(2) Insure that when asphalt bitumen is used only asphalt-saturated felt is used and that when tar pitch is used, only tar-saturated felts are used, except that tar may be used with asphalt-saturated flashing and asphalt-coated rolled roofing.

b. Preparation of Surfaces

(1) See that the entire section of roof-deck construction is complete before roofing begins.

(2) Inspect the roof for being dry, smooth, firm, and dirt-free and free of projections and foreign materials. Check metal roof decks for holes, rust, or repair of paint coat--especially where deck has been welded.

(3) Note preparation and safety protection around roof openings.

(4) Run dryness test on the deck.

(5) Protect roof drain and vent intake during roofing operations. Check for proper drainage at other times.

c. Vapor Barrier

(1) Check locations where the vapor barrier is to be applied.

(2) Observe installation requirement, paying close attention to the nailing and mopping for the installation of vapor barrier on the applicable deck material.

(a) See that vinyl sheets are of proper weight, are abrasion and puncture resistant, and are flexible at low temperatures, as specified.

(b) Test the temperature of asphalt or pitch to make certain that it is not overheated.

(c) Insure that felt is maintained at a minimum temperature of 50° F. for not less than 24 hours prior to laying.

(d) Note ambient temperature prior to placing of vapor barrier.

(e) Does vapor barrier seal edge of insulation at gravel stops, abutting walls and openings? Do not seal with vapor barrier if edge of insulation is vented.

(f) Check for felt edge envelope formed for a vapor barrier bitumen stop where insulation is vented. Install envelope in steep asphalt or bituminous cement at roof edges.

(g) Vapor barrier on gypsum surfaces should not be mopped.

(h) Asphalt-saturated felt vapor barrier on concrete should be mopped in place after priming. If pitch felt is used, priming should not be necessary.

(i) Verify the method of mopping the vapor barrier.

(j) Determine the adhesive bond of the vapor barrier.

(k) Look for an underlayment on the wood deck.

(l) Vapor barrier is not required under insulation on the steel deck.

(m) Hold pitch back from joints in precast roof plank.

(n) Check eave flashings to insure that installation provides for expansion movement.

(3) Inspect the vapor barrier to assure that it provides a complete seal over the deck. See that method of brooming assures complete adhesion to deck, assures complete adhesion between plies, and eliminates air pockets.

d. Insulation

(1) Watch the storage of insulation. Look again prior to installation; only dry insulation shall be placed on roof. For wood fiber insulation check for required treatment and proper application methods for combustible insulation on steel decking.

(2) Note the method of applying insulation to the deck.

(a) Place insulation so that there will be a moderate contact between units.

(b) Secure insulation in place by specified method. Use steep asphalt or nonflammable adhesive on steel decks. Check for bituminous cement or steep asphalt edge-strip bitumen stop on decks or over felt vapor barrier.

(c) Lay insulation immediately preceding the placing of roofing felt.

(d) Keep insulation dry at all times.

(e) Joints should be staggered if application is in more than one layer.

(f) Joints should not occur directly over flute openings in steel deck.

(g) At end of day's work, see that insulation in place is covered with layer of felt which has been hot mopped to the insulation and deck.

(h) See that roof drains are not installed on top of insulation.

(3) Insure that procedures for the application of pitch and asphalt are as described for vapor barrier.

(4) Observe requirement for underlayment over steel deck.

(a) Underlayment is selected and applied under same conditions as insulation except thickness is determined by steel deck flute width.

(b) Inspect the actual installation.

(5) Check the necessity for using runways to support mechanical equipment.

(6) Where nailing is required, evaluate nails for type, spacing, and holding power.

e. Vented Gravel Stop

(1) Check requirements for ventilated gravel stops, and if required, check treatment, grooves, sizes and anchorage.

(2) Watch fabrication and installation of edge nailing strips, insulation stops and vented gravel stop. Make sure the grooves are on the bottom and provide a minimum of 10 percent free edge opening.

f. Roofing Application

(1) Verify the type of roofing required.

(2) Maintain roofing felts at a temperature no less than 50° F. for 24 hours prior to use.

(3) Asphalt and pitch kettles are prohibited on roofs. Use of open flame producing equipment on roofs during roofing operations is prohibited.

(4) See that felt is laid at right angles to the slop of the deck.

(5) Determine lap, nailing, and quantity of pitch or asphalt applied.

(6) Is ambient temperature at or above the specified 40° F. limit and rising?

(7) Evaluate temperature of bitumen or pitch as it is being applied.

(8) Note the method of laying the felt that is immediately behind the mopping of pitch, and assure that the felt is broomed-in so that the layer will be free of air pockets, wrinkles, and buckles.

(9) Check the requirements for and the installation of smooth roll roofing.

(10) Examine the method of installing roofing at cant strips, on vertical surfaces, and in reglets.

(11) Check for two extra plies of felt at eaves and rakes for envelope bitumen stop. Check for application to deck of insulation in steep slope asphalt or bituminous cement.

(12) Check for extra strips hot mopped over edge of gravel stop and other metal roof flashings including lead type.

(13) Is the gravel stop embedded in plastic bituminous cement and nailed on top of the envelope formed by the turnback?

(14) Check aggregates for surfacing:

(a) Has aggregate been sampled and approved for use?

(b) Is aggregate dry and free from dust, sand, loam, and other foreign material?

(c) Is stone waterworn and free from sharp, flat and angular pieces?

(d) Is slag crushed, blast-furnace slag? (If you cannot tell visually, check certificate of compliance.)

(e) Is aggregate spread while bitumen is still hot? Is it thoroughly and evenly embedded in hot bitumen? Have aggregates and bitumen been applied at the specified weights per unit area?

(f) Check for the removal of loose aggregate when required.

(g) Check method of transporting and storing aggregate on roof to assure that felt and flashing has not been damaged and to prevent excessive loading of roof in localized areas.

(15) Flashings - See 208-02. Check for flashings at all projections through roofing. Check for vented nailers at vertical leg of base flashings.

(16) See that drains and vents are unplugged. Clean fasciae, parapets, coping, and gutters.

(17) Check to see that the roof drains have been set at proper location and elevation, that they are properly flashed and that they are clean and provided with gratings when roofing is completed.

(18) Is a roofing sample being taken each day? Check sample immediately for free water, bitumen skips and weight. Record results and replace sample unless a deficiency exists. Sample may be replaced depending on nature of deficiency provided a firm understanding can be reached prior to replacement.

(19) If finished or unfinished roof sections are used for wheelbarrow traffic, check to see if temporary wood runways are provided.

207-02. STRIP SHINGLE ROOFING

a. Preparation for Installation

(1) Have samples been submitted and approved? Do shingles on site match the approved samples?

(2) Is roof clean, dry, and otherwise ready for roofing? Check to cover knot holes and splits with sheetmetal plates.

(3) Are flashings installed or on hand to be installed concurrently with roofing?

(4) Check for proper installation of felt underlayment and metal edge drips if required.

(5) Check type of gutters. If they fasten to sheathing under the shingles, they should be installed prior to laying shingles.

b. Installation

(1) Check starter course of shingles, at the eaves. Is it a double or triple layer of shingles? Does this starter course extend 3/4 inch beyond eave line to form a drip?

(2) Check alignment of layers and rows of shingles. Start rows at center of roof for spans over 30 feet and lay to chalk lines or other guide for a neat job.

(3) Check exposure of shingles on hips and ridges. Are all nails concealed?

(4) Check that each shingle tab is cemented in place with bituminous cement with a contact area of at least 1 square inch. Check self-sealing type shingles.

(5) If self-sealing shingles are used, is the manufacturer's warranty furnished by the contractor providing that if, within a period of 2 years, the shingles tear or blow off the roof, the manufacturer shall be responsible for replacement of blown-off or damaged shingles?

207-03. PLASTIC BASE FLASHINGS

a. General

(1) Flashing is required in locations indicated on the drawing and as necessary to make the construction watertight.

(2) Check the location of the raggle or flashing groove prior to building of the walls.

(3) Check the method of flashing.

b. Asphalt Primer

Check the priming of concrete and masonry surfaces on which asphaltic plastic cement is to be applied. Assure that surfaces are thoroughly dry prior to the application of bituminous cement.

c. Bituminous Elastic Cement

Check the number of plies being placed. The one on top is always mineral-surfaced.

d. Installation

(1) Check for proper anchoring or keying of flashing. The raggles or grooves in which flashings are installed are between 8 and 14 inches above the roof.

(2) Check for the use of a thick (50 pounds per 100 feet) trowel-applied bituminous plastic cement for applying felts and mineral-surfaced facing.

(3) Check the actual setting and cementing of flashing strips.

(4) Check the length of each flashing sheet laid on the roof and the distance it extends up the vertical surface. Also, check distance each ply extends out onto the roof. Mineral-surfaced roofing strips should always be cut from the width of the material and laps made with well-cemented selvage.

CHAPTER 208
SHEET METAL
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CHAPTER 208
SHEET METAL

208-01. PREPARATION FOR INSPECTION OF SHEET METAL WORK

a. Shop Drawings and Samples

(1) Do the construction and the installation comply with shop drawings?

(2) Do the materials match the approved samples?

b. Stiffness - Are exposed edges of all flashings folded back a full 1/2 inch?

c. Expansion joints - Examine specifications for spacing of joints in all sheet metal work. Check plan, specifications and shop drawing for design of the expansion joints.

(1) Note the specification table for spacing of expansion and contraction joints for the various materials.

(2) Inspect the location of joints with respect to corners and such items as downspouts and opening.

(3) Check drawings for details of expansion joints. See if space has been allowed for expansion.

d. Dissimilar Materials

(1) Evaluate the entire job to see that all dissimilar metal materials in contact, which may support galvanic action, have been isolated from each other. Some typical examples to watch for are:

(a) Copper and aluminum flashings in contact with each other, or with ferrous material.

(b) Copper and aluminum flashings nailed with ferrous nails.

(c) Aluminum and ferrous equipment bases set on copper flashings.

(2) Determine specification requirement for method of isolating dissimilar materials.

208-02 INSTALLATION

a. Fastening: Check requirements for:

(1) Nailing and cleating the types, for action and for location.

(2) Soldering, welding, bolting, riveting, etc.

(3) Check detail on drawing for fastening or securing ends or edges in concrete or masonry construction

b. **Gravel Stops and Fascia**

(1) Has nailer been provided for fastening flashing to roof deck, and is nailer slatted properly for venting roof deck?

(2) Check inner flanges for 4 inch length applied over roofing felt and for being nailed 3 inches on center.

(3) See that inner flange is set into a bed of plastic cement.

(4) Mop two plies of roofing felt, one 9 inches wide and one 12 inches wide, over inner flange.

(5) Check the method of anchoring lower edge of fascia.

(6) Check for the full width of folded-back-edge that holds the cleats.

c. **Metal Base Flashing**

(1) Is base flashing installation being started after roofing felt has been placed in the angle formed by the roof and the vertical surface?

(2) Check the size and thickness of the flashing (at least 8 inches up vertical surface and 4 inches on roof.)

(3) Check the lap and the locked and soldered seams.

(4) Examine the installation for secure anchorage, and for size, spacing, and fixing of cleats.

(5) See that roof flange and cleats are covered with two plies of felt, similar to application of felts at the gravel stops.

d. Cap Flashings

(1) Check the fabrication of the cap flashing for size and shape. See that there is at least a 2-inch space between the top of the metal base flashing and the top of the cap flashing, and that the cap flashing laps the base flashing by at least 6 inches. Also see that cap flashing ends near the top of cant or roof surface.

(2) See that flashing is being extended into masonry wall not less than 3 1/2 inches or into reglet, and that cap flashing is securely anchored.

(3) Is lower edge of flashing folded back 1/2 inch?

e. Through-wall Flashing

(1) Carefully check for locations requiring through-wall flashing.

(2) Assure that the flashing is being installed in the middle of the mortar joint.

(3) Check the design and installation requirement for the various locations of flashing, such as: above the roof line, below the roof line, at the lintel, and at the sill, etc.

(4) Check requirement for metal type flashing: the laps, the amount of turn-up, the location in the wall, and the length of material to extend outside the wall.

(5) Sill flashing is always required to extend the full depth of sill and at least 4 inches beyond the end of sill.

(6) Check for the use of a smooth copper slip joint at the end of lintels between the control joint and the wall opening.

f. Spandrel-Beam Flashing

(1) Have surfaces, to which flashing is to be applied, been coated with an

asphalt primer followed by a coating of roofing asphalt? The flashing should be applied before the roofing asphalt sets up.

(2) Is the spandrel beam flashing marked with the manufacturer's name or the brand name?

(3) Do joints between sections of flashing consist of at least 3-inch laps thoroughly cemented with plastic cement?

(4) Check anchor holes to see that they are completely filled with plastic cement.

(5) Flashing is to be cut off flush with exterior wall surface.

g. Hip and Ridge Flashing

(1) Check fabrication of flashing, method of securing, and length of lap.

(2) Are the proper screws and washers being used?

h. Valley Flashing

(1) Check installation for width of material, width of exposed material, and length of lap.

(2) Check cleating operation and flashing anchoring.

i. Stepped Flashing

(1) Check for neat installation with proper depth insertion into wall, adequate length of material nailed on the deck and 3-inch lap.

(2) Any joint between the edges of shingles and the flashing are to be filled with plastic cement.

j. Edge Drip Strip

(1) The strips are provided under fascia over 5 inches wide.

(2) Check fastening to supporting construction and fascia.

(3) Check for the required washers, which are electrolytically compatible, tc hold the strips away from vented gravel stops.

k. Louvers

(1) Check fabrication for first class workmanship.

(2) Check louvers after installation for watertightness against a driving rain.

(3) Examine specifications for requirement for such items as insect or bird screen, movable shutters, etc.

l. Reglets

(1) Make sure the proper reglets are used at the proper places.

(2) Check the setting of reglets in concrete and masonry, to assure a method of firm and secure anchorage. Is the reglet fitted with fiberboard or other suitable separator to prevent crushing or filling of the slot during installation?

(3) Check the contractor's proposed provision for containing sheet metal in reglets. Also check the actual firmness of the flashing as installed.

m. Gutters

(1) Recheck approved gutters, for type, shape, general design, and layout. Make sure that the gutters are supported so that they permit freedom of movement.

(2) Check pitch of gutter and provide drainage to outlets.

(3) Check reinforcement members and hangers for size, type, location and spacing.

(4) Check basket strainers for gutter openings into downspouts, and check bird screens or sheet metal covers for downspout heads.

n. **Downspouts**

(1) Check fabrication of rectangular, longitudinally-corrugated downspouts.

(2) Check downspouts for being factory fabricated and corrugated longitudinally in approximately 10' lengths.

(3) Check seams and joints, making sure that expansion joints are provided as specified.

(4) Check for the requirement for specials, such as downspout heads, scuppers, linings, etc.

(5) Check to see that the downspouts are plumb, that they clear the wall, and that they are firmly secured with 2-inch-wide straps, strapped at each section. The bottom strap is to be slotted to allow movement.

(6) Check downspouts terminating in drainage line. They should be neatly fitted and secured with plastic cement.

o. **Miscellaneous**

(1) Check for miscellaneous sheet metal items, especially those shown on the plan but omitted from the specifications.

(2) Check those items which have been included in the specifications. Check items such as snow guards, splash pans, radiator-recess linings, perimeter insulation covers, etc., for type required, for fabrication, and for method of installation.

CHAPTER 209

FURRING (METAL), LATHING, AND PLASTER

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CHAPTER 209

FURRING (METAL), LATHING, AND PLASTER

209-01. MATERIAL APPROVAL

a. Submittals and Samples - Has the contractor submitted all specified samples and/or descriptive data and shop drawings for approval? Has approval been received?

b. Checking Material Brought on Job - Do materials match approved samples and/or descriptive data?

209-02. FRAMEWORK FOR PLASTER

a. Metal Study Partitions

(1) Check studs for galvanizing or protective painting.

(2) Check study spacing and anchorage.

(3) Double up studs at jambs of openings.

(4) Has 1 1/2 inch channel brace been anchored to double studs at head of each opening? Has 3/4 inch channel brace been anchored above each opening to the three studs adjacent to each jamb?

(5) Anchor studs to adjoining walls or columns at 5-foot centers, with no less than 3 anchors.

(6) In steel stud partitions more than 10 feet long or 9 feet high, have horizontal channel stiffeners been installed on 6 foot centers vertically?

(7) Study contract provisions carefully for anchorage and plaster coat sequence for solid plaster partitions of metal lath and channel studs of gypsum lath in single or multiple thickness.

b. Metal Furring for Suspended Ceilings

(1) Check size and spacing of runner channels.

(2) Check size and spacing of furring channels.

(3) Check size and spacing of hangers. Are hanger wires saddle tied or are hanger straps bolted to runner channels? Are hangers suspended plumb?

(4) Have the methods of wire tying and/or type of wire clips been approved?

(5) Check furring prior to installing lath, for conformance to a true level plane surface.

(6) Are wide chases, which are bridged with furring channels, secured to solid construction on both sides of chase?

(7) Check tie wire material and size used for tieing furring channels to runner channels and for tieing metal lath to furring.

209-03. LATHING

a. Check screeds and grounds for a true, level, plane surface. Screeds will be used to supplement wood or metal grounds to obtain a true, level plaster surface.

(1) Are metal screeds as long as possible? Are splices backed up with splice or tie plates?

(2) Are sufficient plaster screeds set out for leveling scratch and brown coats?

(3) Set screeds and grounds for a minimum plaster depth of 5/8 inch over metal lath and 1/2 inch over gypsum lath.

b. Are single-length corner beads provided on all external corners?

c. See if corner lath is installed for internal corners where abutting surfaces are:

(1) of different materials.

(2) of Gypsum lath.

(3) of Metal lath. (Except flat base lath that can be bent around corner.)

(4) of Masonry.

(5) At ceiling-walls locations. (Except where metal lath of suspended ceilings can be bent down to lap wall lath, or at floating ceiling.)

d. Is metal strip lath installed over

joints between dissimilar base materials?

e. Check method of fastening lath to furring and to studs. Check size, type, and spacing of fasteners or ties. They must be corrosion-resistant steel.

f. Check gypsum plasterboard, gypsum lath, and rock lath.

(1) Are end joints staggered in alternate courses?

(2) Are end joints on opposite sides of partitions staggered so they will not appear in the same course on opposite sides of the same stud?

(3) Are joints in walls staggered with respect to joints in ceilings?

(4) Is every section of lath secured to bearings at both ends and to all intermediate bearings?

(5) Are nails driven flush with firm, full bearing, but with no damage to paper surface? Renail if paper surface is broken.

g. Metal Lath - Check:

(1) the type of metal lath. Does the type of lath being used conform to the type and spacing of supports?

(2) Lapping of lath sheets.

(3) Whether end laps are staggered. Do they occur only over supports?

(4) Method of attaching lath to furring.

h. Check for control and contraction joints.

(1) Plaster control joints are necessary at masonry and concrete control joints.

(2) Check for lath support framing or blocking at both sides of control joints.

(3) Check for struck contraction joints in cement plaster finish coats.

209-04. PLASTER

a. Preparation for Plastering

(1) Mix plaster according to specified proportions. Check mixing of lightweight aggregate plaster closely. Check the set of plaster to determine whether accelerator is needed.

(2) In the building which is to be plastered, assure that a minimum temperature of 55° F. is established one week before the plastering operation begins and

is maintained until the plaster is dry.

(a) Place heating devices near center of room. Do not direct a blast of heat directly onto the plastered surfaces.

(b) Provide regulated ventilation to uniformly change the air, to remove moisture, and to aid in drying the plaster.

(3) Have masonry and concrete surfaces, to which plaster will be applied directly, been roughened, cleaned and dampened? Check bond adhesive manufacturers instructions before application of adhesive to concrete surfaces when this method of bonding plaster to concrete is used.

b. Application

(1) Check the number of coats required, and check the application of each coat for thickness, density, and smoothness. Check the total thickness of plaster.

(2) Thoroughly dampen dry base coats before applying finish coats.

(3) Check for requirements of special finishes.

(4) Check the curing of plaster.

c. Correction of Defects

(1) Remove and replace plaster having cracks, crazing, blisters, pits, checks, or discoloration.

(2) Patching of defective work shall be permitted only with permission of the Engineer. Key the patching to the existing work, and match the existing finish in texture and in color.

CHAPTER 210
RESILIENT-TYPE FLOORS
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CHAPTER 210

RESILIENT-TYPE FLOORS

210-01. MATERIALS

a. General

(1) Has the contractor submitted samples and obtained approval of all materials needed for the installation of Resilient-type floors?

(2) Compare material delivered to the job site with approved samples, and double check the material against contract requirements.

b. Asphalt, Vinyl-Asbestos, Vinyl and Rubber Tile, and Linoleum

(1) Compare color or colors of tile with approved samples. Check carefully to see that the color is as light as specified, and that the coloring goes completely through the tile. Check for the requirement of a different color border.

(2) Check type, size, and thickness of tile.

(3) Check primer.

(4) Check the adhesive or cement.

(5) Check such miscellaneous items as felt lining, edge strips, wax, etc.

(6) Examine base for compliance with the requirements concerning size, thickness, color, cove, and molded external and internal corners and end pieces.

210-02. SUBFLOORS

a. Existing Flooring - Check condition of subflooring for receipt of flooring.

b. Preparation

(1) Have all foreign materials been removed.

(2) Have joints and cracks been filled with filler material recommended by the flooring manufacturer?

(3) Does the surface require sanding or grinding to produce a true, level surface?

(4) Is additional fastening or rigidity necessary?

(5) Have defective materials been removed and replaced?

210-03. PREPARATION FOR PLACEMENT

a. Felt Lining or Underlayment

(1) Note location requirements. For example, asphalt tile is usually required to be installed over plywood, while other types of tile may be placed over wood strip flooring.

(2) Check placing and rolling of felt in place. Are edges butted with crossjoints staggered? Is the applied felt free of bubbles?

b. Temperatures

(1) Has flooring material been stored as required at the specified temperature?

(2) Is the building being maintained at the specified temperature?

(3) Will the contractor be able to maintain the temperature necessary during installation?

c. Final Preparation

Defer the actual installation of flooring until the completion of all other work which may cause damage to the flooring.

210-04. INSTALLATION

a. Check the proposed laying pattern, making certain the opposite borders are of equal width.

b. See that tiles are cut only at base, at outlets in floor, and at border where a diagonal pattern is used.

c. Check adhesive operation.

(1) Determine if the cement is being applied in the proper manner and at the proper rate.

(2) The cement must have the proper dryness and be tacky before applying the floor covering.

d. Look for tight joints, straight lines, and smooth, level surfaces.

e. Roll sheet flooring (linoleum and vinyl) with a 150 lb. roller. Start at center of floor and work toward edges to remove all air bubbles and wrinkles.

f. Check entire length of base for firm contact with walls and floor.

g. Provide temporary protective covering over finished floor, and keep intact until building is complete.

h. Witness application of wax when waxing is required.

CHAPTER 211

DAMPPROOFING AND WATERPROOFING

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CHAPTER 211
DAMPPROOFING AND WATERPROOFING

211-01. SURFACE PREPARATIONS

a. Cleanliness and Smoothness

(1) Have all holes, joints and cracks been pointed flush with mortar?

(2) Has all excess mortar or concrete been removed from surface of walls?

(3) Have rough or high spots been ground smooth?

(4) Is surface free from all foreign matter including sand, soil, and dust?

b. Dryness

Check dryness of the surface to be coated. Is ambient temperature above 40° F.?

211-02. INTERIOR DAMPPROOFING

a. Plans and Specifications

Check both plans and specifications carefully for extent of dampproofing. There is a tendency to short-change on the height of dampproofing on exterior of walls.

b. Application

(1) See that the temperature is above 40° F.

(2) Always apply dampproofing before furring walls.

(3) Check for application of approved prime coat for both tar and asphalt dampproofing systems, and for asphalt waterproofing system. Check temperatures of materials.

(4) Check coating for breaks after a surface has been dampproofed.

(a) Check surface air voids in monolithic concrete.

(b) Reseal all voids not sealed by original application.

211-03. WATERPROOFING

a. General

(1) Check the requirement for primer.

(2) See that the ambient temperature is above 40°.

b. Application

(1) The felt plies and pitch or asphalt waterproofing are applied in the same manner as for built-up roofing.

(2) Asphalt and tar vapors are flammable, open flame and other sources of ignition are prohibited in enclosed areas. Adequate ventilation must be provided. In addition vapors from tar products are toxic and irritating. Adequate personal protective measures must be taken. Asphalt and tar kettles are not to be permitted in enclosed structures.

(3) Carefully check the application of felt and pitch at intersections, the length of turn-up required at walls, etc.

(4) Carefully check the installation of flashing and the lapping and mopping of waterproofing at flashing and around items passing through the waterproofing.

(5) Check the application of the waterproofing for exact conformance with the specification regarding:

(a) The poundage of pitch.

(b) Temperature of pitch.

(c) Type and application of membrane.

(d) Wrinkles and buckles.

(e) Requirement for reinforcing strips.

(f) Requirement for membrane at control joints.

(6) Make sure that all waterstops, flashings, etc. have been correctly installed to provide a watertight job.

(7) See that membranes are always protected from damage. Check the requirement for type of protection to be installed where backfill is to be placed. Check for:

(a) Type of board required.

(b) Method of bonding board to waterproofing.

c. Insulating Fiberboard

Check for protective layer of insulating fiberboard over waterproofed surfaces against which backfill is to be placed.

(1) Fiberboard should be pressed into the final mopping while the mopping is still hot.

(2) Never allow fiberboard to be attached by cut nails or by any other method which results in holes through the membrane.

(3) If fiberboard fails to adhere properly, an additional hot mop coat should be applied in which to embed the board or, with the Contracting Officer's specific approval, a suitable mastic cement may be used.

CHAPTER 212
CORRUGATED ROOFING AND SIDING
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CHAPTER 212
CORRUGATED ROOFING AND SIDING

212-01. SHOP DRAWINGS AND SAMPLES

a. Material Approval

(1) Has the contractor received approval of layout drawings and such material as protected steel, asbestos-cement or aluminum corrugated sheets, cement or putty, fasteners, special shapes and accessories?

(2) Has the contractor's method of installation and erection procedures been approved?

b. On-Site Checking of Materials

Approved shop drawings, samples, and installation instructions will continually be used to check against contractor's operation.

212-02. STORAGE AND PROTECTION

a. Storage

(1) See that materials are properly stacked and protected from traffic and weather.

(2) See that material is stacked in a manner that will avoid abuse.

b. Protection

(1) Material will be handled in a manner that will avoid breaks, cracks, chips or other defects.

(2) Check material upon arrival at the site and while being handled at the site for any defects and reject defective material.

212-03. INSTALLATION

a. Fastening

(1) Check the cement for color, type, and method of application.

(2) Check fastener for type, size and spacing.

(3) Check for washers. There is usually a requirement for lead, neoprene, or metal-capped neoprene washers.

b. Application

(1) Check length of side and end laps.

(2) Check for proper drilling and cutting.

(3) See that all accessories and special shapes are provided in conformance with shop drawings as necessary to make a complete and watertight installation.

(4) Expansion joints should be provided as detailed.

CHAPTER 213

METAL DOORS, DOORFRAMES, AND WINDOWS

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CHAPTER 213

METAL DOORS, DOORFRAMES, AND WINDOWS

213-01. GENERAL

Make sure that shop drawings, samples and certificates have been obtained and approved adequately in advance of the need for the material.

Check each item as it arrives on the job site against approved shop drawings.

213-02. MATERIALS

a. General - Doors, doorframes and windows should generally be checked for:

(1) Size - Compare the size, shape, and thickness of the doors, doorframes and/or windows with approved shop drawings, opening dimensions, and contract requirements.

(2) Materials - Compare materials in the components of the items with contract requirements for type, thickness, etc.

(3) General Construction or Fabrication - Check for standard manufactured products and for first class workmanship. Check for such things as smooth edges and joints, straight members, and adequate stiffness.

(4) For hollow metal and tubular steel doors, check doors for additional reinforcing requirements for hardware. To do this, observe when contractor drills for surface applied hardware. All face sheets on doors must be backed up by a 14 Ga. steel plate where surface applied hardware occurs. Check for closure channels at top and bottom of exterior doors.

(5) Defects, warps, buckles, etc.

(6) Type and installation of factory-applied hardware.

(7) Finish - Check appearance, and compare the type of finish with contract requirements.

(8) Operation - Note the operation of units for proper functioning.

b. Specific

(1) Doorframes

(a) Inspect the assembly of the frames.

(b) Watch for additional reinforcing when required at head, corners, and hardware.

(c) Compare location and size of frame mortises, reinforcing and holes with hardware approvals and with fabricated doors. Check carefully for special cutouts and reinforcing.

(d) Verify provisions for anchorage.

(e) Determine special requirements for light-proof, sound-proof, and lead-lined fire doors, etc.

(2) Fire Doors

(a) Notice whether door has the proper Underwriter's classification.

(b) Check for door manufacturer's applied hardware.

(3) Hollow Metal and Tubular Steel Doors

(a) Determine whether flush or panel hollow metals are required, and determine the locations of each type.

(b) If there is reasonable doubt that the construction of the door does not comply with requirements, consult your supervisor concerning the use of a destruction test.

(c) Check the fabrication at edges and where joints occur in the metal.

(4) Rolling Steel Doors

(a) Locate the operating mechanism. It should be on the inside of the door.

(b) Check curtain fabrication and apparent ease of operation.

(c) Check for weathertightness and wind lock when required.

(d) See if a compressible bumper has been provided on exterior doors.

(e) Check the guides and the manner of securing to structure.

(f) Check provisions for adjusting spring tension.

(g) Examine operating mechanisms such as rollers, locking devices, and operators.

(5) Overhead and Vertical Lift Steel Doors

(a) Compare the type of construction specified with the type provided.

(b) See if the doors are constructed to be watertight.

(c) Verify the ease of operation.

(d) Look for compressible bumper on bottom edges of doors.

(e) Inspect the track and guides, and the method of anchoring.

(f) Note the means for adjusting tension.

(6) Horizontal Sliding Steel Doors

(a) Make sure the doors are mounted on the inside of exterior walls.

(b) Examine the fabrication of door.

(c) Determine the method of mounting and operating door.

(d) Check for requirement of safety devices.

(7) Aluminum Doors and Frames

(a) Doors and frames should come as one unit.

(b) Look for the use of factory-standard products that are fabricated of extruded aluminum.

(c) Watch for the contact of dissimilar materials. Make sure the proper protective coating has been applied to the surfaces which will come in contact with each other.

(d) Observe the method of anchoring frames.

(3) Examine fabrication for milling, dovetailing, interlocking, reinforcing, etc.

(8) Vault Doors; Check for:

(a) Fire-resistant classification.

(b) Special bolting.

(c) Fire-resistant, classified locks.

(9) Accordion Doors

(a) Framework should be metal cadmium-plated or zinc-coated.

(b) Examine doors for pantograph action with hinges and hinge plates.

(c) Check depth, shape, gage, and finish of track.

(d) See that carriers are the wheel type, are spaced not over 24" on center, and are noiseless.

(e) Note the type and weight of door covering material. Check for such requirements as being sound-proof and fire-resistant.

(10) Windows, General

(a) Know the type of window which is required for each opening.

(b) In addition to seeing that a certificate is furnished, stating that the window conforms to industry requirements, compare the window construction with the applicable industry specification.

(c) Compare windows shipped to the site with approved window sample.

(d) Check thickness and gages of metal.

(e) Examine the rigidity of unit and the maximum width allowed. If there is any question as to the structural soundness of the window units, you should talk with your supervisor about sending the window to a laboratory for testing.

(f) Verify the proposed method of anchoring the units.

(g) Be sure windows are fabricated so as to be complately watertight.

(h) Examine air infiltration certificates and compare weather-stripping and construction of tested unit with the unit furnished for the job.

(i) Evaluate the proposed method of glazing.

(j) Determine by what method screen and storm sash will be attached.

(k) Inspect screen and storm sash for general construction. Check mesh size.

(l) Note hardware and operation. Watch for metal-to-metal contact of moving parts.

(m) Look for special requirements of such items as special mullions, window cleaners' bolts, trim, stools, casings, pull-down-hooks, poles, and sub-frames.

213-03. HANDLING, STORAGE, AND PROTECTION

a. Handling - Insure the careful handling of all items during transportation both to the job and at the job. Be on the alert for evidences of mishandling, which could result in later complications in the operations of a unit.

b. Storage - Units should always be stored under cover and in a manner that will not cause warping or other damage.

c. Protection - Make sure items are protected from the stacking and handling of building materials, and from the accumulation of cement, lime, etc. Keep units closed unless there is a reason for them to be open. You should expect all items to be like new when turned over for use with the building.

213-04. INSTALLATION

a. Workmanship

(1) Review the initial installation of each item for the work being performed by skilled mechanics who are familiar with the manufacturer's installation procedures, shop drawings, and contract requirements.

(2) Check the alignment of each item. See that it is plumb, square, and level.

b. Performance of Work

(1) Check the actual anchorage of each item.

(2) Using the necessary gages, check all clearances.

(3) See that the required calking is properly provided.

(4) Check for the proper installation of required weather-stripping.

(5) Determine the adjustment of hardware. Actually operate each unit to see that it operates smoothly and easily.

(6) Observe the glazing operation.

(7) Determine the requirements and the need for lubrication.

(8) Check the painting.

c. Cleaning

(1) Note the cleaning operation. Watch especially for inadequate jobs that will result in poor appearance, staining, discoloring and/or the fouling of weathering surfaces, weatherstripping or operating hardware.

(2) Units that cannot be satisfactorily cleaned will be replaced.

213-05. OPERATION AND MAINTENANCE INSTRUCTIONS AND GUARANTIES

a. Operation and Maintenance Instructions

(1) Verify the need for operation and/or maintenance instructions.

(2) Insure that the necessary instructions are obtained and that the equipment is installed according to instructions.

b. Guaranties - Electric-power operators usually require a guaranty. Make sure it is obtained.

CHAPTER 214
CABINETS, CASEWORK AND WARDROBES
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CHAPTER 214
CABINETS, CASEWORK AND WARDROBES

214-01. REVIEW OF CONTRACT REQUIREMENTS

a. Types

Examine contract and become familiar with:

(1) Type of cabinets, casework, wardrobes, and similar items which are required.

(2) Detail requirements for each.

(3) Installation location.

b. Approvals

Check for timely approvals of each unit and review approvals for compliance with plans and specifications.

c. Interferences

Check for interference between cabinets, casework, and wardrobes, and structural, electrical, and mechanical items of the building.

214-02. FABRICATION

a. General

(1) Upon delivery to the job, compare each item with the approved shop drawings and samples.

(2) Carefully compare all dimensions of the cabinets, caseworks and wardrobes with those shown on the shop drawings, and with the available space.

(3) Check gages and types of metal, and check size and species of woods used in the fabricated units.

(4) Check types of finishes provided on both wood and metal units.

(5) Check provisions for fastening and anchoring.

b. Framing

Check:

(1) Sizes of framing members.

(2) If framing construction is satisfactory.

(3) The adequacy of the connections of framing members.

(4) If adequate bracing is provided for rigidity.

c. Wall for Side Panels, Partitions and Bottoms

(1) Check type of material utilized and composition of panels and plates.

(2) See if there is a requirement for special radius of bends at intersections of horizontal and vertical surfaces, and if so, see that this requirement is being carried out.

(3) Check fastenings and joints of panels and plates.

(4) The wood should not contain splices, and metal weld permitted in finish surfaces should be smoothly grounded.

(5) Watch for raw edges.

d. Cabinets and Counter Tops and Splash Backs

(1) Check type, color and quality of material used.

(2) Check dimensions. Especially watch the amount of overhang of cabinet and counter tops and the height of splash backs.

(3) Check method of fastening tops to units.

(4) Watch for raw edges.

e. Base

(1) Note material used.

(2) Check the height and distance from the face of the base to the face of the cabinet.

f. Doors

(1) Check composition, accuracy of fabrication, fit, and thickness.

(2) Check hardware.

g. Drawers

(1) Examine material used in fabricating various parts, and examine the thickness of the material.

(2) Measure size, including depth.

(3) Note guides or runners, bearings and rollers, for method of construction, and the ease and quietness of operation to full, extended position.

(4) Check for specified pulls and stops.

h. Shelves

(1) Check the requirement for adjustable provisions.

(2) Check material and fabrication; usually a one-piece shelf is required.

(3) Watch for the necessity of reinforcement for wide shelves.

i. Molding and Trim

Check the requirements for special moldings, trims, etc.

j. Sinks

(1) Check the provisions for watertight installation, and check plumbing requirements.

(2) Make certain that roughing-in has been properly accomplished.

k. Miscellaneous

Examine the contract for special requirements, such as chases, racks, sign holders, receptacles, etc.

214-03. PROTECTION

a. Determine that care is taken in handling of fabricated items. Damaged items should be replaced.

b. Protect installed items from adjacent construction operation.

214-04. INSTALLATION

a. Assure that installation is being made by skillful workmen and performed in accordance with manufacturers' recommendations and contract requirements.

b. Verify setting of items for proper alignment level and plumb.

c. Check the method of fastening and/or anchoring.

d. Watch for the utilization of dissimilar material together and the utilization of non-compatible fasteners.

e. Make certain that small spaces between walls and installed items are sealed as required.

f. Determine the necessity of fillers.

CHAPTER 215

CALKING, GLASS AND GLAZING

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CHAPTER 215
CALKING, GLASS AND GLAZING

215-01. CALKING

a. Material

(1) Check grade, color, workability and adhesion of calking.

(2) Check for the use of the proper sealer and rope yarn.

b. Area Requiring Calking

Watch for calking around such built-in items as doors and windows, joints in wash surfaces of precast concrete items, and vertical control joints.

c. Preparing for Calking

(1) Do calking materials need testing? If so, check to assure that material used is from batch tested.

(2) Have grooves of adequate depth been provided, and are they cleaned of mortar, dust and foreign matter?

(3) Has rope yarn been packed in grooves where necessary?

(4) Has the required sealer been coated over the surface to receive calking?

d. Application

(1) Make certain that the workmen have the proper type of gun.

(2) See that grooves are solidly filled.

(3) See that appearance is uniform and relatively smooth.

(4) Do not allow smears of calking.

215-02. GLASS

a. Type

(1) Be familiar with the various types of glass required and the locations in which each type is to be installed.

(2) Make certain that each type is approved before it is needed on the job.

b. Characteristics

(1) Watch for use of single strength being used where double strength or stronger is required. Labels should be on the glass. Inspect complete window and/or door units when delivered to job site and prior to installation to assure proper glazing.

(2) Check quality and thickness. These are usually dependent upon use and size of opening.

(3) Evaluate for such requirements as being polished or unpolished, clear or translucent, figured, fire-rating, light-diffusing, heat-tempered, wire, heat-absorbing, laminated, corrugated, insulating, etc.

c. Other Materials

Determine requirement and approval of putty, glazing compound, glazing tape, glazier pointers, nails, screws, shims, separators, special channels, beads, etc.

d. Storage and Protection

(1) Pay careful attention to the storage and protection of acrylic plastic sheets.

(a) Sheets, when received, should be covered with tissue paper or masking paper, and protected during storage with the paper intact.

(b) Keep sheets clean and away from direct heat and solvent fumes.

(2) Make certain that acrylic plastic sheets are protected from paint, plaster and tar.

(3) See that care is taken in the stacking of all glass to prevent the placing of unnecessary strain on the sheets.

(4) Do not permit storage of insulating glass so as to be subject to high temperature differential such as caused by sun.

e. Glazing

(1) During installation of double insulating glass, do not permit installer to remove glass tips formed during manufacture or allow striking of units against frames or other objects.

(2) Call supervisor's attention that requires glazing with epoxy or similar hardening-type material for glazing.

(3) See that glazing rabbets and beads are double primed prior to glazing.

(4) See that each piece of glass bears the manufacturer's label and is free of cracks, chips, etc.

(5) Require conformance with the requirements for embedding, the use of points or similar items, puttying, etc.

(6) Look for the priming of all wood moldings before installation.

(7) Examine the required clearance between sash and panes, especially for acrylic plastic sheets.

(8) Check for a positive seal between the glass and the sash.

(9) Determine the need for plastic shims or separators in glazing aluminum sash.

(10) See that fixed single panes installed in metal sash are being set in continuous vinyl or neoprene plastic channels. The channels should be the proper size to provide a snug fit.

(11) Always watch for installations that could later result in the glazed units not being watertight.

(12) See that corrosion resistant type nails and screws are used in beads of exterior units.

(13) Require removal of masking tape from acrylic plastic as soon as possible after glazing of each sheet has been completed. Removal of some types of masking tape from acrylic plastic sheets subjected to sunlight is difficult without causing damage to the sheets; removal is sometimes impossible.

f. Mirrors

(1) Correlate the type furnished with approved shop drawings.

(2) Determine whether there is a need for testing the mirrors.

(3) Check installation.

(a) Is concealed, non-tamperable installation required?

(b) Has the method of anchorage been built into the wall?

(c) Is mirror required to be installed 54 inches from the floor?

(d) Is the mirror properly centered with respect to fixtures?

g. Cleaning and Acceptance

(1) Make certain that all glass surfaces are cleaned of labels, paint, putty and other defacements.

(2) Check the waxing of acrylic plastic.

CHAPTER 216
TERRAZZO; CERAMIC AND QUARRY TILE
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CHAPTER 216

TERRAZZO; CERAMIC AND QUARRY TILE

216-01. TERRAZZO

a. Materials

(1) Compare the contractor's mix with the specification requirements.

(a) See that the correct proportions of cement, sand, coloring, aggregates, marble chips, and water are being provided.

(b) See that each material to be used in the mix has been approved.

(2) Check for approval of such other materials as strips, inserts, reinforcements, etc.

b. Preparation for Placement of Terrazzo

(1) Inspect texture of the surface to receive terrazzo. If smooth, see that it is roughened as necessary to obtain a good bond.

(2) Make sure that the surface is cleaned of all dirt, oil, grease, and extraneous matter.

(3) Note the setting of division and

edging strips for:

(a) Proper layout.

(b) Secure anchorage.

(c) Solid grout.

(d) Line and grade.

(e) Tightly fitted end joints and intersections.

(4) Determine whether the surface to receive terrazzo is properly moistened.

(5) Inspect the grouting operation for the mix used, quantity, spreading, and leveling.

c. Laying

(1) Examine the laying operation for proper placing, tamping, rolling and troweling operations that will result in a dense, smooth surface, slightly above the finish line of the floor.

(2) Check the method, temperature, and time of curing.

(3) Inspect the grinding operation for a true, even surface with the required appearance.

(4) Determine the need for hand-rubbing in hard-to-get-to places.

(5) Make certain that the floor is properly protected from abuse during placing and finishing operations.

(6) Check the cleaning of the floor for the removal of all stains, cement smears, dirt, etc.

(7) Make certain that a sealing preservative is applied to the clean terrazzo floor.

216-02. CERAMIC AND QUARRY TILE

a. Material

(1) Verify that all materials needed in the installation of the tile have been approved.

(2) Check size, color and pattern of furnished tile.

(3) Compare all materials delivered with approved samples and literature.

b. Installation of Wall Tile

(1) Inspect the preparation for the placement of tile.

(a) Check the location and the anchorage of studs or furring.

(b) Check the lath for placement, lap, and support. See that the lath is tied with zinc-coated wires.

(c) Check scratch-coat and float-coat operations, the composition and workability of the mix used, the application, and the curing.

(2) Inspect the setting of tile for:

(a) Straight, level, perpendicular and uniform 1/16-inch joints.

(b) Soaked tile from which free surface water has been removed.

(c) Firmness of set.

(d) Damaged or defective tile.

(e) Secure installation of accessories.

(f) Proper application by the adhesive method.

(3) Inspect the grouting operation.

(a) See that edges of the tile are thoroughly wet before application of grout.

(b) Check the placing of grout, tooling and cleaning.

(c) Check time, temperature, and method of curing.

c. Installation of Floor Tile

(1) See that the walls are installed before the floors are installed.

(2) Check setting-bed mix.

(3) Check preparation of setting-bed.

(4) Check layout.

(5) Check requirement for such items as waterproofing and reinforcement. In watching installation of reinforcement, make certain that it is properly supported and secured in center of the fill.

(6) Check cutting and fitting of tile.

(7) Do not allow contractor to place excessive setting bed ahead of tiling operation, since tile should not be placed on material that has obtained initial set.

(8) Assure that a solid bedding is obtained.

(9) Closely examine grouting and cleaning.

(10) Examine specifications for areas requiring resinous mortar. Carefully check the application of the mortar.

(11) Determine if expansion joints are needed or required, and check the accurate location of expansion joints.

CHAPTER 217
MOVABLE, ACCORDION AND TOILET PARTITIONS
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CHAPTER 217
MOVABLE, ACCORDION AND TOILET PARTITIONS

217-01. MATERIALS

a. Examine contract and determine the types of partitions required for the job. Make sure early approval is obtained on each, in order to avoid the delay of construction.

b. As each partition arrives on the job, compare all features with approved submittals. Compare doors, screens, panels and framing for such features as:

(1) Size and shape.

(2) Material compositions.

(3) Construction and assembly.

(4) Bracing.

(5) Insulation.

(6) Method of fastening and supporting.

(7) Sound and fire resistance.

(8) Finish and hardware.

c. Determine the need for such items as base, fillers, and plinths.

217-02. INSTALLATION

a. Utilize partition manufacturer's instructions.

b. During the initial stages of construction, check for neat, accurate workmanship. Be alert to minimizing the cutting and drilling of existing structure as well as of the new partitions.

c. Check the fitting, jointing, and anchoring.

d. See that assembly is straight, plumb, and level.

e. Reject any units that are dented, punctured, deeply scratched, or otherwise damaged. Slight mars, abrasions or scratches may be touched up if they can be repaired to match undamaged parts.

f. Check the proper installation of all hardware and accessories.

g. Check sound barrier above suspended ceiling for tight fit around roof deck and over header. This applies to installations accordion type folding doors.

h. Check sweep strip of accordion doors for snug fit at floor.

CHAPTER 218

HARDWARE

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CHAPTER 218

HARDWARE

218-01. MATERIAL

a. Submittals

(1) Make sure that the contractor obtains an early approval of hardware schedule and samples or an affidavit.

(2) Double-check the schedule to assure that you understand it and that no openings have been omitted.

(3) Be alert to hardware requirements and installation on such items as:

(a) Roof scuttles

(b) Toilet and other partitions

(c) Sliding, rolling and lift doors

(d) Refrigerator and other mechanical equipment doors

(e) Screens

(f) Venetian blinds

(g) Curtains

(h) Rollers

(4) Hardware items which need close observation because they are often overlooked are such items as astragals, silencers, coordinators, holders, stops, and thresholds.

(5) Watch for restrictions on use of aluminum.

b. Delivery of Material

(1) See that hardware is obtained for each opening and that the hardware is the same as that which is included on the approved schedule.

(2) Check the sizes of such items as push-, pull-, kick- and armor-plates, hinges, closers, and thresholds.

(3) Check to see that all builders' hardware items arrive at job-site in manufacturers' unopened containers. Boxes, containers, etc., should not be opened until item is ready for attaching to door.

(4) Examine items for the utilization of the correct materials, such as bronze, brass, aluminum, stainless steel, and prime coated steel in the construction of the hardware. Determine whether the material is cast, wrought, extruded, stamped, or forged.

(5) Check the finish of the materials.

(6) Check the characteristics of the operation and the use of the hardware.

(7) Check the keying.

218-02. APPLICATION

a. General

(1) Check for quality workmanship and the proper installation of each item of hardware.

(a) Compare installation with manufacturer's instructions.

(b) Determine the proper installation height and location.

(c) Examine the method of fastening. Evaluate for durability and rigidity.

(2) Make sure that the proper size and type of hardware is being installed on each door and window.

b. Installation Checks

(1) Observe whether there are nonremovable pins in hinges installed on outswinging exterior doors and on doors to

secure areas which swing into corridors for fire safety reasons.

(2) Insure the use of proper closer brackets. Note the installation of closer for adequate clearance between the bottom of the closer and the floor.

(3) Look for the omission of stops and silencers. Watch for installations which will allow hardware to swing into parts of the structure or into other hardware.

(4) Check for the matching of hardware finishes in each area.

(5) See that each item of hardware functions properly after installation.

(6) Check for omission of thresholds and their size and shape.

CHAPTER 219

PAINTING

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CHAPTER 219
PAINTING

219-01. GENERAL

This chapter covers general requirements, preparation of surfaces prior to painting and proper application procedures for the more common types of paint systems.

219-02. GENERAL REQUIREMENTS

a. Check all Paint Containers

(1) Reject paint in broken containers, i.e., containers showing evidence of having seal broken so as to allow evaporation, contamination or loss of materials within container.

(2) Reject paint in containers that are not plainly marked with:

(a) Designated name, formula or specification number.

(b) Batch number.

(c) Color.

(d) Date of manufacture.

(e) Manufacturer's directions.

(f) Manufacturer's name.

(3) Reject pigmented paint in containers over 5 gallons in size.

b. Samples and Testing

(1) Paint should be delivered to site or segregated at source of supply in time to allow 30 days for testing before paint is needed.

(2) Sampling at the site should be done by the contractor immediately after delivery, in the presence of the inspector.

(a) Sampled material should be placed in new one-quart friction top can.

(b) Fill sample can only to 90% of capacity to allow for expansion.

(c) Provide label on each container with the following information:

1. Name of material and specification number.

2. Batch or lot number and date of manufacture.

3. Quantity represented.

4. Project name and address.

5. Particular feature or surface on which paint is to be applied.

6. Construction contract number.

(d) Make sure that the paint is properly mixed when obtaining a sample for testing.

(e) Letter of instruction to testing laboratory should state whether complete or partial testing is required.

(f) Normally, it should take about three weeks to ship, test and receive test results.

(3) Testing and/or storage of samples should be as directed by your supervisor.

(4) When tests are required, the sample should be transmitted to the designated Testing Laboratory as soon as possible.

(5) When contract or Contracting Officer allows Certificates of Compliance to be substituted in lieu of testing:

(a) Check to see that a Certificate has been received for each type and/or batch of paint.

(b) Check paint labels on site against description on Certificate, make certain they are identical.

(6) If samples fail the tests, the materials represented by the samples should be immediately removed from the site.

c. Preparations Prior to Painting

(1) Prepare list of all surfaces requiring paint.

(2) List surface preparation, color, type of paint and number of coats required on each surface.

(3) When painting commences, use the previously prepared list to determine that specifications are being followed.

d. Mixing and Thinning of Paint

(1) As often as possible, the inspector should observe the mixing and thinning of paints.

(2) All paints must be mixed until the pigments are evenly distributed. (Until there is no evidence of settlement on bottom of container and paint in container is of uniform color.)

(3) Do not allow thinning of paint in cold area.

(a) Move paint into area to be painted and allow temperature to rise to room or ambient temperature.

(b) Paint thinned when cold may be too thin at normal temperatures.

(4) Only materials specified or recommended by manufacturer may be used for thinning, but not in excess of one pint per gallon.

(5) Under normal conditions, paint of specified viscosity require only mixing to be ready for use.

(6) Require the paint contractor to demonstrate a need before allowing thinning. The contractor is responsible for maintaining the complete hiding power of the paint.

(7) Paint in the containers should be stirred frequently during period of application. (As often as necessary to maintain a complete dispersal of pigments.)

(8) Paints with aggregate and/or cement filler added require constant stirring and remixing to maintain an even distribution of

filler throughout the entire quantity of paint.

(9) Products of different manufacturers and paints of different types should not be mixed together.

e. Storage of Materials and Safety Precautions

(1) Flammable paint materials should be handled and stored in accordance with accepted safety procedures.

(2) Latex paints must be kept from freezing. Check to see that temperature of storage area is maintained above freezing at all times.

(3) Spray Painting and Blast Cleaning

(a) Personnel operating spray guns should wear approved respirators while spraying.

(b) Adequate ventilation should be maintained at all times during spray painting of enclosed interior surfaces.

(c) In the case of spray painting on interior of tanks, enclosed gates or similar confined spaces, if the specifications do not spell out the amount of ventilation required, then the services of a ventilation engineer should be requested to determine the required amount of ventilation.

(d) Ventilation of buildings should be checked after spray painting operations to determine that all rooms are thoroughly aired and free from fumes before allowing any smoking, open flames or operation of equipment capable of producing sparks.

(e) Blast cleaning operators should wear approved hoods with air fed respirators.

(f) A carbon monoxide alarm device should be included in the air lines feeding air-fed hoods and respirators whenever internal combustion engines are used on the job.

(g) Explosion-proof devices should be used in enclosed spaces during spray painting or blast cleaning operations.

f. General Inspection Requirements

(1) When an inspector is not familiar with specified field tests for painting, assistance by personnel experienced in testing should be requested through the proper channels.

(2) Check specification requirement for minimum temperature at which painting is allowed. Temperatures vary with types of paint.

(3) Check for pretreatment requirement before first full coat of field paint is applied.

(4) Check for touch-up of abrasions, field connections and shop markings on shop-coated metals before field coats of paint are applied.

(a) Check for requirement of tinting undercoats for positive identification of the number of coats.

(b) If a dry film thickness is specified, rather or in addition to the number of coats, check with thickness gage.

(6) Check specifications and manufacturer's instructions carefully for special methods of mixing, thinning, or application of paints.

(7) All surfaces to be painted should be clean, i.e., free from rust, dust, scale, oil, grease, or any coatings that would impair adhesion of the film or the finished appearance.

(8) For all paints, except water-thinned paints (Latex and Cement-Water), surfaces should be dry before paint is applied. (Note: Surfaces to receive latex and cement-water paints should be damp.)

(9) Even with surface in a dry state, check atmospheric conditions. Painting should be avoided during periods of high humidity.

(10) When temporary heating is required during periods of low ambient temperatures:

(a) Commence heating well in advance of start on painting.

(b) Make certain surface to be painted is up to specified temperature, as well as the surrounding air. (Don't guess, use a thermometer).

(c) Check for condensation on surface to be painted, especially if warm air heating is used.

(d) Temperature of painted surface and surrounding air should be maintained at or above the specified minimum until paint has thoroughly dried. (The universal test for dryness is the finger - if paint film is not tacky and moderate rubbing of surface with finger does not mar surface, it's dry.)

(e) Limits on moisture content are specified for absorbent materials such as wood and plaster. By use of moisture meter, make certain that moisture content is within allowable limits before painting is started.

(11) Observe the condition of paint in the container, even though tested and approved; the following doncitions are causes for rejection:

(a) Heavy skinning, i.e., thick rubbery membrane of congealed or solidified paint over surface of paint in container.

(b) Gelling or livering, i.e., pigments reacting chemically with some other constituent of the paint to form semi-hardened lumps which cannot readily be broken down and remixed with the rest of the paint.

(c) Gassing, i.e, chemical reaction between paint constituents to the point of giving off gas-determined by observing bubbles of gas rising to surface of paint and possibly, in some cases, by an unusual odor. In Latex paints, this could be an indication of paint that had been exposed to several cycles of freeze-thaw.

(d) Excessive settlement, i.e., pigment settlement to bottom of container solidified to the point that normal mixing procedures do not disperse it. Minor amounts of settlement are to be expected in many paints, but the settled pigment should readily disperse by stirring or shaking.

(e) If any of the above conditions are noted and there is doubt as to whether there is cause for rejection, request assistance from personnel trained in paint technology.

(12) Protect previously finished surfaces and surfaces and equipment which are not to be painted from spillage, spray and any kind of damage which might result from painting operations.

(a) Check to see that hardware, machined surfaces, radiators, lighting fixtures, electric motors, and similar items are either removed during surface preparation and paint operations or suitably protected.

(b) All finished floor surfaces should be protected by drop cloths.

(13) The application of paint on all surfaces should be checked before starting to paint or certainly at the very beginning of each application.

(a) Establish minimum acceptability standards for finished appearance at the start of painting operations.

(b) If there is a difference of opinion as to what constitutes acceptable standards, bring it to the attention of your supervisor so that the question can be resolved early enough to avoid corrective action after a major part of the work has been painted.

(14) Glossy undercoats should be lightly sanded before application of a succeeding coat.

g. Specifics on Application of Paint

(1) Observe the painted surfaces for paint runs, drops, ridges, waves, laps, brush marks, and for variations in color, texture, and finish.

(2) Inspect application of each coat for uniformity of thickness and coverage.

(3) See that all masonry surface voids, pores, and cracks are filled with cement filler, and cement latex filler when the painting of masonry is specified.

(4) Insist on proper curing of cement filler.

(5) Determine between-coat drying requirements.

(6) Evaluate the method of application. Rolling and/or spraying are not always allowed.

(7) Make sure that edges, corners, crevices, welds, rivets, etc. obtain treatment and coverage equivalent to that of the adjacent surfaces.

(8) Insure that the first coat on both faces of wood doors are painted at essentially the same time.

(9) Prevent the application of latex paint over calking compound.

(10) Exterior poured concrete surfaces are not to be painted unless specifically authorized.

(11) In stain work, check that nail holes and imperfections are not putty-stopped until after the wood has been stained and that putty-stopping, when applied, is stained to match the stained wood.

CHAPTER 301

PLUMBING, GAS PIPING, SPRINKLER SYSTEMS, AND MISCELLANEOUS PIPING SYSTEMS

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CHAPTER 301

PLUMBING, GAS PIPING, SPRINKLER SYSTEMS, AND MISCELLANEOUS PIPING SYSTEMS

301-01. GENERAL

a. Definition

This chapter covers materials, equipment, and good workmanship practices for the various types of piping systems.

b. Approvals

Insure that all material is approved prior to need, and prior to installation. Obtain any helpful manufacturer's installation information.

c. Storage and Handling

(1) Insure that all materials and equipment are handled carefully to prevent damage.

(a) Reject damaged materials.

(b) Have damaged coatings repaired.

(2) In handling heavy pipe use wide belt slings to avoid damage to pipe coatings.

(3) Check storage facilities for adequate weather protection, possible damage, and safety hazard.

(4) Where outside storage is necessary, store materials and equipment above ground.

d. Coordination of Work

Continually check interferences between electrical, mechanical, architectural, and structural features especially in equipment rooms and above suspended ceilings.

e. Layout

(1) Know how the piping system fits into the total job.

(2) Check grades and locations of piping with respect to other features of the building.

(a) Check number, size, and location of sleeves before the floors and walls are placed. Sleeves must be large enough to contain insulation or calking.

(b) Do not cut structural members, when necessary get approval from supervisor.

(c) Do not install lines below and through footings if possible.

(d) Check for proper pipe hangers and supports.

(3) Check expansion requirements, specifically for swing joints at branch connections which are required by the specifications but are not usually shown on the drawings.

f. Protection

(1) Keep trash and debris out of pipes, fittings, and fixtures.

(2) Cap or plug lines when work is not in progress, at the end of each day's work, or where future connections are to be made.

(3) Check all embedded items for secure anchorage to avoid displacement during concrete placement.

(4) Check plugs or forming around drains to insure that no concrete flows into them.

g. Plumbing Fixtures

Inspect the plumbing fixtures upon arrival at the job site for conformance with contract requirements. Require adequate storage and protection from damage before and after installation. Insure that fixtures are installed in compliance with contract requirements and good plumbing practice.

301-02. PIPING; GENERAL

a. Threading

Examine the threading operation:

(1) Are pipes squarely cut?

(2) Is threading being performed properly?

(3) Check for thread length required for particular pipe size and see that threads are not undercut.

(4) Are cutters sharp, and are they being handled so as not to shave threads?

(5) Are ends of pipe being reamed properly?

(6) Never allow calking of threaded pipe.

(7) Check cutting oil used.

(8) Protect floors from oil stains at cutting and threading machines.

(9) Check requirements for use of wrought iron pipe (identified with a red stripe).

b. Pipe Connections

Examine all pipe connections:

(1) See that screwed joints are made up tightly, but not tight enough to strain the fitting. See that only proper thread lubricant or approved tape is used and is applied to male thread only.

(2) Do not screw pipes against the web of globe valves, or against the underside of seat rings of gate valves.

(3) When connecting valves to pipes see that wrenches are used on the end of valves being screwed onto the pipes, in order to prevent damage to the valve bore. If it is necessary to put wrench on the opposite end of valve from the end being screwed onto pipe, use a nipple that has been screwed into the valve. Always be alert for distorted valves.

(4) Do not use spud wrenches and drift pins when installing flanged joints.

(5) Brighten both the male and female parts of joints to be soldered prior to making joint. Do not permit short-cut fluxes that are alleged to clean and tin in one operation. Permit only noncorrosive paste flux and solid string or wire solder of percent tin and percent lead specified.

(6) Use threaded pipe connections to connect angle stops at plumbing fixtures.

(7) Discourage the frequent use of close nipples. Remember that the joints may later need disassembling.

(8) Make sure that all welded joints are properly made and that the welder performing the work is certified and has been approved. If there is any question about the adequacy of any weld, it should be tested.

c. Placing Pipe

(1) Check alignment and grade of pipes.

(2) See that pipe is solidly supported.

(a) Obtain adequate compaction of trench bottom.

(b) Are pipes resting on solid bearing? Pipe should not be supported by the bells, nor on brick, block or wood members.

(c) Are the proper type hangers used? Check against specification.

(d) Are the hangers spaced properly and have hangers been provided near each change in direction of the line?

(e) Have thrust blocks been provided as necessary?

(3) Watch for too many bends being incorporated into a line.

(4) Watch for bent pipe that shows kinks, wrinkles, or other malformations.

(5) See that necessary air chambers are provided as shown on the drawing to eliminate pipe hammering.

(6) Note bedding and covering materials for and adjacent to pipes. Do not permit the presence of boulders or debris.

(7) Check "painted on" coatings on buried pipe immediately prior to placement to insure soundness of the coating around the pipe circumference.

d. Fittings

(1) Provide unions as required.

(2) Be certain that the proper valves are installed in all required locations.

Also check to assure that all globe and check valves are properly oriented with respect to flow.

(3) See that valves are installed with the stems horizontal or above.

(4) Check nonfreeze type wall hydrant for proper installation. End exposed in building should be as inconspicuous as possible and not present a safety hazard.

301-03. SOIL, WASTE, DRAIN AND VENT PIPING

a. Material

(1) Check pipes and fittings for type and weight, and whether coated or uncoated as specified. Check pipe wall thicknesses against standards.

(2) Determine whether the fittings are drainage pattern type and that hub and spigot pipes are cast iron.

b. Installation

(1) Check drainage piping for uniform slope and alignment.

(2) Do not place lines in the way of footings. Where this condition is unavoid-

able, provision must be made to avoid direct pressure on the pipe; check with your supervisor.

(3) Make sure lines have been tested and are without leaks before covering the pipe.

(4) Check compacted bed of underground drainage piping.

(5) Check foundation drainage flow.

(6) Install floor cleanouts with tops flush with the finished floor. Brass countersunk head screw plug will be used normally. Apply graphite lubricant to male threads.

(7) Check floor and areaway drains for type, size, sediment basket or backwater valve. Pitch floor to drain.

(8) Install traps close to the fixtures. Grease interceptors do not require a trap. Allow no double trapping of fixtures. Check for flow control device between fixture and grease trap.

(9) Permit slip joints only in trap seals or on the inlet side of traps.

(10) Check requirements for dielectric unions.

(11) Insure that roof drains have clamping ring for lead flashing.

(12) Use proper fastener material for aluminum or copper flashings.

(13) Check roof, parapet, and cornice drains for type and size. Set at, or slightly below, low roof points.

(14) Check flashings for leaks.

301-04. WATER PIPING

a. Materials

(1) Evaluate valves for type, size operation, location, and accessibility.

(2) Be certain that access panels are provided for valves located behind ceilings and walls.

(3) Provide chrome-plated supply and waste piping, as required.

(4) Do not allow the use of galvanized and brass or copper pipes and fittings in the same run unless approved dielectric connecters are used for underground piping or piping for service over 160°F.

(5) Observe size, type and finish of floor, wall, and ceiling escutcheons. Make sure thay are installed at proper time, if fastened to sleeves.

(6) Compare the type and thickness of insulation approved with that being used.

(7) Examine fixture installation for complete trimmings; fittings; shut-off valves; vacuum breakers, if required; and for imperfect fixture finish. Reject fixtures as necessary.

b. Installation

(1) Check supply piping for outside service lines to the building for type, size, location, elevation, and interference with other underground utilities. Check clearances between water and sewer lines. Do not install water and sewer lines in the same trench side by side.

(2) Insure that in large structures water service is such that portions of the system may be isolated for repairs without interrupting service in entire building. Also valves should be provided on supply piping to all fixtures and equipment for maintenance purposes.

(3) Check location of air chambers as shown on the drawing.

(4) Check allowance for expansion and contraction of piping. Also check anchorage of lines at specified intervals for underground piping for service over 160°F.

(5) Place exterior underground piping below the frost line.

(6) Do not permit cross connections between potable and nonpotable water supply or sewer drains.

(7) Do not apply insulation until lines are tested for underground piping or piping for service over 160°F.

(8) Insulation application:

(a) Check insulation passing through sleeves in walls, floors, and ceiling, if required.

(b) See that the approved type of insulation is being installed in the manner specified.

(c) Insure that insulation is being applied over fittings, valves, flanges, and unions; is of the same material and thickness as the adjoining pipe insulations; and that the insulation consists of premolded, prefabricated, or field fabricated segments of pipe insulation.

(d) See that the insulation contains a vapor barrier covering, and that:

1. The covering is of the proper type, weight, and thickness.

2. The covering is continuous without breaks at hangers, and all discontinuities and penetrations which to exist are sealed with an approved vapor barrier coating.

3. A vapor barrier seal is provided at 12-foot intervals and at fittings, flanges, and valves as specified.

(e) See that high density insulation sections and sheet metal shields are installed at pipe hangers when specified.

(9) See that pipe hangers are secured to structure in specified manner.

(10) Examine the installation of fixtures. Notice the rigidity of supports. Check position and level setting of the backing provided for hanging fixtures.

(11) Check fixtures and fasteners for the types required, and for installation in

the various type walls.

(a) Chair carriers are not specified. Carriers for wall hung water closets are required.

(12) Observe the levelness of the fixtures and the setting of the flanges and traps.

(13) Insure that fixtures are protected during construction, and prohibit the use of fixtures until the plumbing system is completed and tested.

(14) Check temperatures and pressure settings of relief valves. Pipe to a floor drain or to outside of building as required. Insure that temperature relief valves have thermo element that extends into the top 6 inches of hot water tank.

(15) Check sterilization operations for proper dosage, distribution, retention, and final flush-out.

(16) Check shower drain during installation to insure that shower pan is tightly secured in clamping ring device. Membrane waterproofing in concrete floor under shower drain must also be clamped in the clamping ring around the drain. Metallic pans are to receive a mopped coat of asphalt on both sides.

(17) Check piping identification system for type, location, spacing, and neatness.

(18) Determine if water piping is pitched to low points, and whether the system can be drained in entirety. Check for drainage cocks and plugs.

(19) Provide a gate valve and drain on the service line inside the building close to the floor or wall.

301-05. ACCESSORY EQUIPMENT

a. General

Evaluate equipment, such as cooling water pumps, circulating pumps, booster pumps, pneumatic water systems, water dispensers, water heaters, and thermostatic mixing valves for capacity and performance in accordance with specifications and approvals. Know manufacturer's recommendations for proper installation, particularly clearances.

b. Installation

(1) Check hot water generators for storage and recovery capacities, correct tappings, proper location of inlet and outlet connections to avoid short circuiting of cold water, and ASME approval.

(2) Provide union or flanged connections at equipment.

(3) Determine relief valve type, size, temperature and/or pressure setting for correctness. Pipe relief valves to drain. Assure that temperature relief valves have the thermo element that extends into the top 6 inches of hot water tank.

(4) Check accessibility of heating coils for maintenance purposes.

(5) Evaluate supports, frame and cradles for type, size, and construction.

(6) Check installation of controls, regulators, and flues.

(7) Require test of hot water generator operation after installation.

(8) Check flexible connections and vibration eliminators. Are they the type and material specified?

(9) After the cleaning of equipment inspect for properly applied, approved insulation.

(10) Check the alignment of equipment, particularly pumps with motors.

(11) Be sure that the proper pressure gages and thermometers are installed as required.

(12) Check the rotation of pumps and motors.

(13) Inspect to see that all piping of the equipment has been installed to provide an approved, workable installation. Check carefully the valve orientation with respect to flow.

(14) In the installation of sump pumps, compare the length of the shaft with the depth of the sump.

(15) Closely check the complete control system and the functioning of each control.

(16) Check for proper pipe support during installation. Do not allow cast pump housings to carry weight of piping.

301-06. GAS PIPING

a. Safety

(1) Avoid installation of gas lines under buildings or in trenches with other utilities. When such installation is necessary, carefully check the specifications for special requirements.

(2) Require strict adherence to safety regulations.

(3) Indicate principal shutoff valves and make them accessible for operation in case of emergency.

b. Installation

(1) Install gas lines above other utilities where they cross and slope down to drip valves or capped drips at low points.

(2) Do not permit soldered joints in any gas lines.

(3) Contact utility company for local specification requirments.

(4) Be sure the plug cocks, gas-pressure regulators with automatic cutoffs and insulating couplings are installed as required.

(5) See that line from relief vents from gas pressure regulators are not located adajacent to air intake openings to building.

(6) Check specifications and plans for location of drip pockets at all low points in the main. If no requirement, contact your supervisor for resolution.

(7) Be sure there is an insulating fitting on service line.

(8) When underground pipe is coated and wrapped:

(a) Be sure that welded joints of steel, cast iron, or wrought-iron pipe are properly hand coated and wrapped.

(b) Be sure that all joints of cast iron, wrought-iron pipe are electrically bonded and that the bond is properly covered with coal tar and epoxy resin mixture suitable for this use.

(c) Be sure that backfill does not contain material that will harm pipe coating.

301-7. Tests

a. Preparation

Prior to the test, see that:

(1) All valves at the ends of lines are closed.

(2) Open ends of pipe are capped or plugged.

(3) The line is anchored and the end blocked to prevent damage.

(4) All diaphragms or other internal parts of valves and equipment will withstand the test pressure without damage, or have them removed before test is started.

(5) Test procedures and scheduling are reviewed.

(6) Gages, instruments or other equipment to be used for testing have been certified or prechecked before testing.

(7) You have a knowledge of proper test pressures for pressure piping and allowable leakage rates for gravity lines.

b. Testing of Lines

Check following tests:

(1) Drainage and venting systems - preliminary, water or air test; final, smoke or peppermint test.

(2) Water systems - hydrostatic test.

(3) Compressed air and vacuum piping - pneumatic pressure test.

(4) Nitrous oxide and oxygen piping - in accordance with National Fire Protection Association Bulletin 565.

(5) If pressure loss is excessive, test must be rescheduled.

301-8. CLEANING, ADJUSTING, OPERATING

a. Cleaning

(1) Inspect metal surfaces to be cleaned.

(2) See that all grease, paint spots, and debris are removed.

(3) Check chlorination of water piping for specified ppm of chlorine and time for proper sterilization.

b. Adjusting

Examine adjustment of all fixtures, devices, and controls.

c. Operating

(1) Observe operation and maintenance instructions of the system by the contractor or the manufacturer's representative. Record the names of persons receiving instructions and furnish this information to your supervisor.

(2) Check posting of operating and maintenance instructions and the furnishing of spare parts.

(3) Examine all certificates and written guarantees and check applicability to the specific equipment furnished.

301-09. SPRINKLER SYSTEMS

a. General

(1) Check approvals of materials and equipment schedule. Be familiar with the requirements of the National Fire Protection Association.

(2) Insure shop drawing approvals, prior to fabrication of any work.

(3) Assure that fire protection systems serving occupied buildings are not shut off for repairs without advance notice being given to proper authorities.

(4) Note valves and equipment proposed for location within reach of flood waters. Call to the attention of your supervisor.

(5) Do not take water from fire mains for domestic use.

(6) Identify painting and coding requirements.

b. Materials

(1) Coordinate fire department hose connections for use with local fire department hose.

(2) Inspect pipe, fittings, and valves. Pipe that is properly reamed is free from burrs and fins.

c. Water Supply

(1) Evaluate plan of work to minimize interruption of water service.

(2) Insure that water line is located below local frost line.

(3) Block off ends of supply lines terminating in building or valve house.

(4) Be certain that pipe joints are left exposed until final inspection and tests are made.

(5) See that turns in supply line are braced, blocked or clamped.

d. Aboveground Piping

(1) Notice size of pipe. Check to insure all hangers are tight.

(a) Run parallel to building lines, with slope to drain.

(b) See that branch piping is off top of main.

(c) Where impossible to obtain an even slope, plugs should be provided at low points so that the entire system may be drained. Check for inspection test connections required by NFPA.

(2) See that no cutting of structural members for support or passage of pipe is allowed.

(3) Insure that holes through fire walls are provided with sleeves and plates. Sleeves will be provided where pipe passes through walls and floors.

e. Sprinkler Heads

(1) Be sure that heads in accordance with NFPA 13 are installed in upright position with recommended clearance to roof or ceiling surfaces.

(a) When in pendant position return bends will be used if water is subject to sedimentation.

(b) Where subject to mechanical injury heads will be provided with approved guards.

(c) All heads will be new and should not be painted.

(2) Determine sprinkler head temperature ratings as proper for ambient temperatures anticipated in the area; e.g., near heaters, skylights, etc.

(a) Notify your supervisor in instances where sprinkler head temperature ratings appear to be inconsistent with anticipated ambient temperatures.

(3) Spare heads should be provided and arrangements made to transfer them to the using service.

(4) Where sprinkler heads are shown to be installed in special hazard areas, such as electronic shops, confirm that installation will be in conformance with area usuage.

f. Drains

See that valves or plugs are provided to insure drainage of the entire system. Assure that discharge from all drain valves is visible. They should be arranged so that wide open valve position under normal pressure will not cause any water damage.

g. Wet Pipe Systems

(1) Insist that piping layout is in strict accordance with approved drawings.

(2) Alarm check-valve assembly must conform with connection diagram.

(3) Observe installation of water-flow indicators for conformance with connection diagram.

(4) Confirm insulation and painting requirements.

(5) Check water flow alarm signal by using wet pipe type of inspector's test connection.

h. Dry Pipe Systems

(1) Determine that piping layout is in strict accordance with approved drawings.

(2) Note dry pipe valve installation for conformance with connection diagram.

(3) Inspect installation of air compressors. Air supply line should include flexible connection and orifice plate. Check motor controller operation. If compressor is equipped with an air storage tank, assure that condensate water drain is provided at bottom of tank.

(4) Examine locations and operation of condensate chambers; i.e., drum drips.

(5) Check water flow alarm signal time and dry valve trip test time by using the dry pipe type of inspector's test connection.

(6) Where dry pipe valve accelerators are provided, check for proper operation.

i. Deluge Systems

(1) Confirm that piping layout is in strict accordance with approved drawings.

(2) Examine installation of deluge valve assembly.

(3) Inspect and test releasing devices.

(4) Check tripping devices both manual and automatic. Check provisions to insure against accidental water damage.

(5) Insure that contractor provides portable test units in good working order.

j. Sterilization

Witness dosage, distribution, retention, and final flush-out.

k. Alarm Facilities

(1) Check installations to insure tha all alarm devices have been provided and a in operating condition.

(2) Be sure that electric power for alarm signals is taken from the house current supply line ahead of the main switch

(3) Examine alarm system for tie-in with local fire department.

(4) Check alarm to insure that it can be heard above normal noise levels.

1. Testing

(1) Review test procedure for adequacy, and witness all tests.

(2) Protect dry pipe valves against damage during the tests.

(3) In testing extensions to existing system, insure that self-indicating blanks are used. Remove upon completion of tests.

(4) Insure that all sprinkler contractor's certificates covering materials and tests are properly executed.

(5) Insure that flushing and hydrostatic tests are made in accordance with the accepte

tests specified in Standard 13 of the National Fire Protection Association.

301-10. MISCELLANEOUS PIPING SYSTEMS

a. Compressed Air and Vacuum Piping Systems

(1) Check materials and equipment for conformance with approved shop drawings.

(2) Review contractor's proposed layout for interferences, maintenance accessibility, equipment locations, and proper hangers and supports.

(3) Provide drip pockets at low points.

(4) Exhaust piping from vacuum pump should be piped to outside of building with end turned down and screened.

(5) Check pressure-reducing regulators for proper settings.

(6) Joints in vacuum piping should be made with silver brazing alloy except at valves and equipment requiring threaded connections.

(7) Are antivibration couplings located between the vacuum pump and piping?

(8) Is aftercooler and moisture separator in piping located between air compressor

and receiver, if required? Check plans and specifications.

(9) Are identification tags provided for valves?

(10) Check station outlet for UL conformance.

(11) Check color coding requirements in specifications.

(12) Has testing as required by specifications been accomplished?

b. Nitrous Oxide and Oxygen Piping Systems

(1) Installation and testing should conform with National Fire Protection Association Standard 565.

(2) Check for approved materials and equipment.

(3) Verify the use of nonmetallic ducts or casings for underground piping.

(4) Check for cleanliness of piping. Refer to specifications for requirement.

(5) Assure the use of silver solder for making joints except at valves and equipment requiring threaded connections.

(6) Between each cylinder in a bank of cylinders and manifold connection, verify the presence of a check valve.

(7) Check for high pressure filter between manifold and manifold pressure regulator.

(8) Check manifold pressure relief valve for type and relief setting.

(9) Check alarm system operation.

(10) Have identification tags for valve been provided for and attached?

(11) Check outlet for UL conformance.

(12) Check color coding requirements in specifications.

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